

ABSTRACT

Title of Document: DUBAI DETOX:
AN ALTERNATIVE URBANISM OF
CLIMATE, CULTURE AND PLACE

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Dubai, the largest city in the United Arab Emirates, recently experienced a spectacular building boom. The new city—a string of setpieces including palm-shaped islands, manmade marinas and soaring skyscrapers—bears no resemblance to traditional Middle Eastern urban settlements. The end of the boom has left many building plans unrealized. These holes in the urban fabric present strategic opportunities to challenge Dubai's prevailing car-dependent, energy-intensive development model.

This thesis proposes design possibilities for an undeveloped 100-hectare area adjacent to a Dubai Metro rail transit station. Using climate and culture as determinants in the design process, time-tested urban, landscape and architectural responses are applied and transformed to the creation of a new settlement pattern. The resulting urban design "kit of parts" provides a flexible framework for transit- and pedestrian-oriented development that accommodates varied densities and building types, simultaneously privileging public space and respecting cultural values of privacy and separation.

DUBAI DETOX:
AN ALTERNATIVE URBANISM OF CLIMATE, CULTURE AND PLACE

By

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Chapter 1: Historical Settlement Patterns

...Western building and planning codes are rooted in patterns diametrically different from those that evolved in the Islamic world...Yet the current predominant attitude in the Arab and Islamic world has been, and still is, that modernization and technological developments necessitate these radical changes. Nothing, of course, can be further from the truth; careful study will indicate that technological requirements are not incompatible with the essential organizational features provided by the traditional Arabic-Islamic city.

Besim Hakim

(Arabic-Islamic Cities: Building and Planning Principles, p. 164-5)

...[T]he very form of the city, as it is manifested through architecture and the places that it frames, reveals civilization's deepest political, cultural and social understanding of human relationships.

Pier Vittorio Aureli

("City's Degree Zero: Polis vs Planning, or City-making in the West and East," Cities from Zero, p. 26)



Figure 1. Dubai's identity shifts depending where the observer stands; the historic center recalls older Middle Eastern cities, while the new skyline of Sheikh Zayed Road symbolizes ambition with glass and steel.



Figure 2. The United Arab Emirates and Dubai in global and regional context.

Dubai's Desert Roots and Traditional Building Culture(s)

What is now the highly urbanized Dubai, a city-state in the United Arab Emirates [Figs. 1 and 2], was once a sparsely inhabited desert landscape that could support only small groups of nomadic peoples, chiefly the Bedouin. For centuries, these tribes migrated with their animals from one oasis to the next, developing along the way sophisticated responses to the extreme climate. Fiercely territorial and loyal to family and tribe, the Bedouin were also known for their hospitality, music, poetry and textile design.

While the vast majority of Emiratis today live in permanent urban settlements, the Bedouin tent [Fig. 3] endures as a symbol of their preindustrial culture. Woven from dyed camel or goat hair, the opaque black fabric provides deep shade while admitting dif-

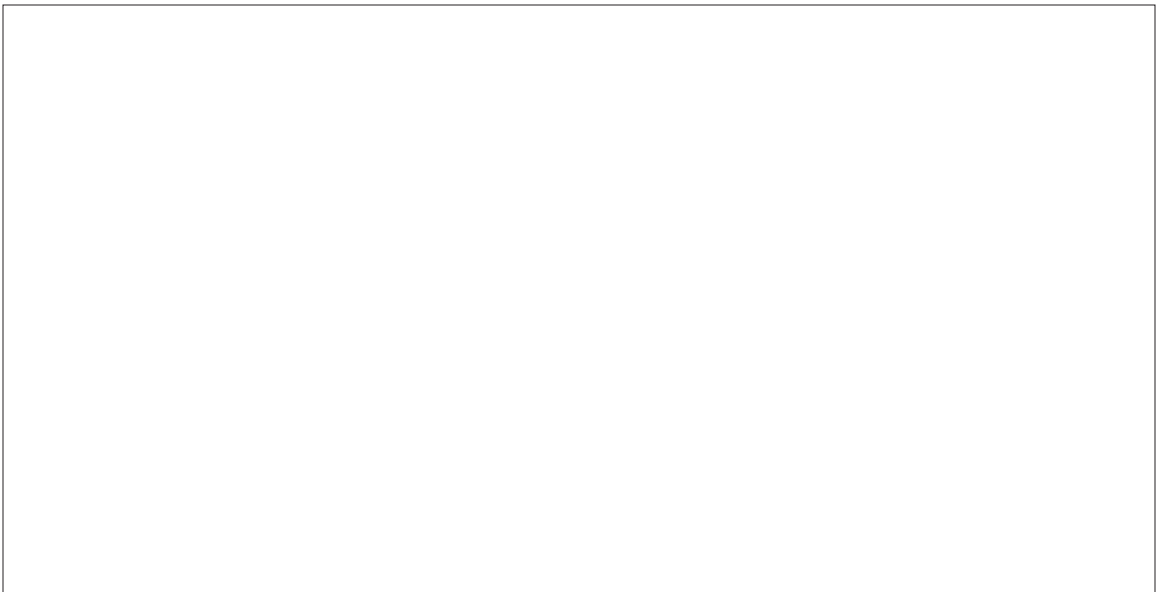


Figure 3. The Bedouin tent is a model for sustainable shelter.
Accessed Dec. 13, 2010. <http://willes.byu.edu/images/JF19.jpg>.

fuse, speckled daylight. As the fabric heats, hot air trapped inside the tent rises and vents to the outside, creating a convection current that makes the interior floor space feel relatively breezy and cool. In the rare event of rain, the fibers swell and the tent becomes a watertight skin. And, of course, the tent is eminently portable.¹

As world commerce and technology reached the region in the 1700s and 1800s, Arab settlements began to develop on the coast of the Persian Gulf. People spent the summer near the shoreline, fishing and pearling in the shallow Gulf; they spent winters inland, farming and ranching around desert oases. A British naval officer reported in 1822 that a population of 1,200 was living in mud houses in the village of Dubai.² Dubai was a stop on the caravan route between Iraq and Oman, but most of its trade came by sea. Dubai Creek, an inlet of the Gulf, became a significant hub for exchange with Persia, Africa, India and even China; since 1900, Dubai has been the largest port on the Gulf.

An early Dubai housing type, the barasti hut or *khaima* [Fig. 4], was more permanent than a Bedouin tent but shared many of the same features. The structure was made of palm tree trunks; the walls and ceiling was made of densely woven palm

1 Accessed Dec. 13, 2010. http://www.mcdonough.com/writings/new_geography.htm.

2 Karim 1.

and coconut tree fibers. Like the Bedouin tent, the barasti hut's materials were rapidly renewable and locally available, and its woven skin admitted diffuse light and breezes while protecting inhabitants from direct sunlight and radiation. In summer, the attached burlap wind tower (modeled after the *barjeel*, a Persian innovation) helped ventilate the house, expelling stale, hot indoor air and capturing cool breezes.

In the late 19th and 20th centuries, traders and merchants from Persia and other parts of Arabia quickly joined the "native" Bedouins in the already-polyglot city, bringing their own building culture to Dubai. They built one- and two-story adobe courtyard buildings, densely packed along narrow, canvas-covered alleys (*sikkas*) that were shaded for most of the day. Wealthier families built their houses with coral stone and gypsum, while poorer families used mud. In deference to the privacy of the family and particularly of women, openings on the street level were small, recessed and screened by patterned metal or wood lattices. The Bastakiya neighborhood, settled in the 1890s, is one of the last remaining examples of this traditional Middle Eastern urbanism in the city [Fig. 5]. It has been renovated and preserved as an artifact of the old Dubai.

By 1900, the city supported a population of 10,000 and was ruled by local sheiks partnered with British authorities; the



Figure 4. The barasti hut often incorporated a wind tower to ventilate the interior.



Figure 5. The historic Bastakiya neighborhood was recently renovated to represent its "historic" identity.

British offered naval protection in exchange for political control in the Gulf region. Because this was a city of traders, large *suqs*, or marketplaces, organically developed on both sides of Dubai Creek. The World Wars and the Great Depression retarded economic development throughout the Middle East, but Dubai continued to serve as the largest Gulf port. Through the 1950s, the city lacked electricity, plumbing and other modern infrastructure, and most people lived in barasti huts lining the unpaved streets. Dubai didn't have a single concrete building until 1956.³ However, a technological revolution was just around the corner. The discovery of massive oil reserves in the 1960s and 70s, coupled with the sheikhs' profound will to build, would transform the region from a backwater to a major presence on the world stage.

Industrialization and Explosive Growth

Abu Dhabi, Dubai's longtime competitor 90 km to the southwest, struck it rich in the 1960s with the discovery of massive oil reserves. Dubai was not far behind; oil reserves were found in 1971. In the same year, the United Arab Emirates was formed from a group of seven Arab city-states that had been formally released from British control.

3 Karim 2.

Fueled by oil money and driven by ambition, the Al Maktoum dynasty, Bedouin descendants who have ruled Dubai since 1833, envisioned a transformed city that would be fully engaged in the global economy. Aware of the emirate's dwindling petroleum reserves (Abu Dhabi has the lion's share in the UAE), Sheikh Rashid bin Saeed Al Maktoum focused on transforming Dubai into a hub for free trade and tourism. Because there was no educational infrastructure in the region for training architects, engineers and planners, the state hired Western professionals, which perhaps inevitably resulted in Western-style urban development and design patterns [Fig. 6]. The shortage of native-born professionals persists today, ensuring that expatriate talent will continue to be needed in Dubai.

A British architect, John Harris, created masterplans for modern roads and infrastructure in 1960 and 1971. The city was electrified in 1961, and a massive deep-water port, an international airport and a financial trading center quickly followed. The population grew from 60,000 in 1967 to more than 200,000 a decade later.⁴ The 1970s and 80s saw a forest of glass and concrete skyscrapers rise along Dubai Creek, near the heart of the old city. Sheikh Zayed Road, which connects Dubai with the capital city of Abu Dhabi, was modernized, eventually becoming a 12-lane

⁴ Karim 6.

highway notorious for traffic jams.

In the 1990s and 2000s, a Singapore-inspired scheme of tax-free corporate investment zones was implemented to spur development west of the city center, parallel to the coast along Sheikh Zayed Road [Fig. 7]. A ban on foreign real estate (free-hold) ownership was lifted in the late 1990s, fueling a speculative real estate market that pumped money into the Dubai economy. After 9/11, Middle Eastern and Asian investors discouraged from investing in American markets poured billions of dollars into these free trade zones. The city's population grew to one million, peaking by some estimates at more than 1.5 million before the 2009 real-estate crash.

State-sponsored development companies—with brand names, Nakheel and Emaar, that are as omnipresent in Dubai as Coke and Pepsi are in America—focused in the 1990s and 2000s on creating icons, including palm-shaped islands visible from space and the world's first “six-star” hotel. Two expensive symbols of the city's desired “world-class” status, the Burj Khalifa [Fig. 8] and the Dubai Metro, opened for business in 2010 just as the news broke that Dubai World, an umbrella organization for development and investment companies, could not make payments on its \$80 billion debt.

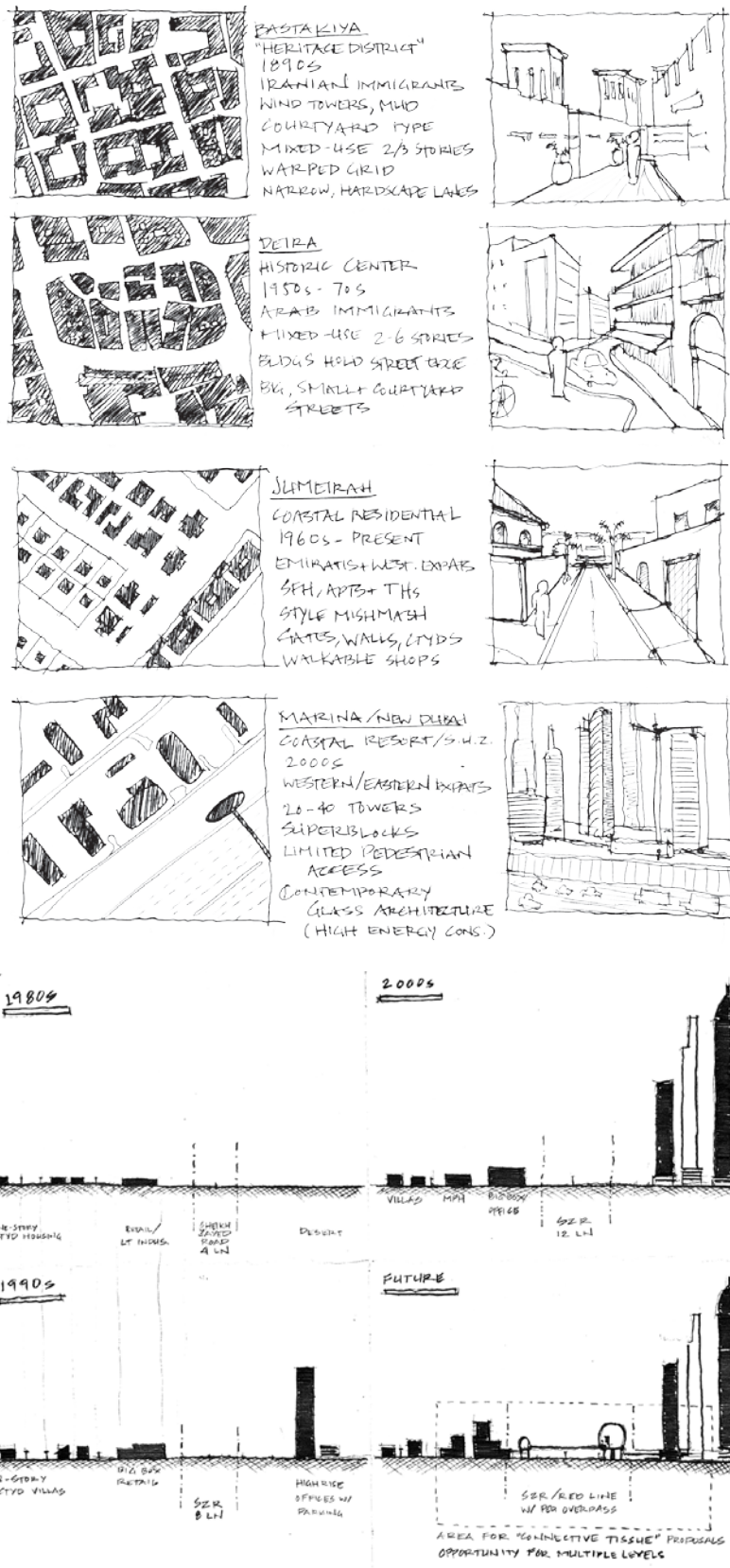


Figure 6. Evolution of Dubai's urban morphology.



Figure 7. Free-trade zones provide tax incentives for foreign corporations to invest in Dubai. These zones are overwhelmingly single-use—all office, all high-rise housing, all light industrial, and so on.



Figure 8. Dubai's rulers have constructed their vision of the city as a high-tech business hub with a tolerant social climate and *laissez-faire* business rules. The Burj Khalifa, background left, is the city's newest icon.

My own experience of Dubai in January 2010 revealed a city that bet its life on the concept that “if you build it, they will come.” Indeed, many foreigners have come to work in the vast service, banking and professional industries. The luxury high-rises of Dubai Marina, a large development close to the Palm Jumeirah and Internet City, were approximately one-quarter to one-third occupied during my stay. Throughout the city, shops and restaurants remained open for business but were rarely crowded. The busiest public spaces I observed were the large shopping malls that dot the city. Offering connections to public transit, ample covered parking and, most important, air conditioning, the shopping mall is to Dubai what the piazza is to Rome—the best place to go, meet friends and sit down for a (nonalcoholic) drink.

Despite the bursting of the real-estate bubble, Dubai remains a destination for investment, shopping, tourism and trade, largely because it offers an anything-goes, laissez-faire economic and social climate available nowhere else in the Gulf region.

After the Boom: Dubai Today

The city’s rapid transformation is awe-inspiring, yet has many troubling repercussions. The Dubai economy depends on a huge underclass of workers—construction laborers, janitors, maids, cooks, retail clerks, taxi drivers and others—from India,

Bangladesh, Pakistan, the Philippines and other parts of South-east Asia. Wages are low and exploitation is high. A large middle class of Middle Eastern and Asian professionals is forced by high real-estate costs to live far from the city center; they endure commutes measured in hours, not minutes. Western expatriates (most from English-speaking countries) drawn to Dubai by boom-time jobs are now leaving as the economy slows.

The highest social rung is occupied by Emirati citizens, who claim ancestral relation to the Bedouin tribes that once inhabited the region. Emiratis, who make up less than 10% of the population, receive legal protection, housing subsidies, free public education and preferential hiring for government jobs.

If the city is a mixing bowl, its ingredients are oil and water. These diverse groups of people come into contact, at least visually, with one another, but they do not often mix. Communities of expatriates drawn by economic opportunity tend to live, work and eat together, with many people biding their time until they can return home. Western women in bikinis walk on the beach in direct view of completely veiled Emirati women, but the two groups rarely interact.

Dubai has little functional public space—free, open places that support gathering and social exchange. The reasons for this are both cultural and climatic—during the summer months,

spending time outside in an unshaded urban landscape can be hazardous. Traditional Arabic-Islamic cultural norms encourage families to associate in private, behind walls and forbid women and girls from socializing with unrelated men. Outside the home, social gathering takes place largely within indoor, air-conditioned consumer environments, particularly shopping malls [Fig. 9] and themed resorts and hotels. Non-commercial cultural amenities, such as art museums, symphonies, theaters and libraries, are rare.



Figure 9. The shopping mall is to Dubai as the piazza is to Rome: it is the place to go to see and be seen. To lure visitors, malls offer unusual attractions, such as this aquarium inside Dubai Mall.

Despite the many downsides of Dubai, it remains a fascinating case study of the emerging 21st-century urbanism(s) of the Middle East and Asia. For the city to remain viable, it must maintain its economic health and turn its attention to developing livable, sustainable communities. The current economic downturn creates an opportunity for Dubai to expand its brand—as not only a luxury destination, but also a place for the middle classes to live, work and raise families. This thesis proposes only one of many possible strategies for this expansion.

Chapter 2: Climate + Site

Dubai's Climate

Dubai is flanked to the south by the vast deserts of the Arabian Peninsula, but the city's coastal location makes its climate significantly more humid than the arid inland regions. The subtropical climate is characterized by long, cloudless days year-round, with high humidity in the winter and moderate humidity in the summer. In the summer, the sun passes almost directly overhead at noon [Fig. 10].

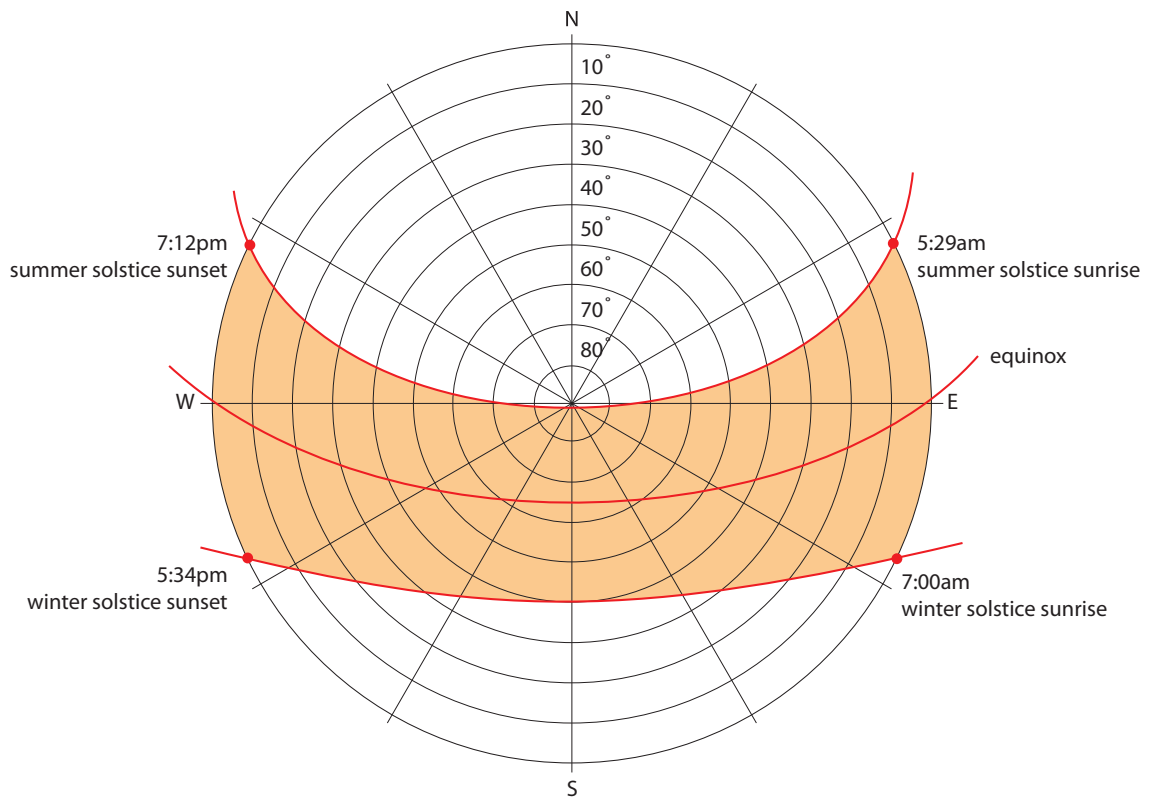


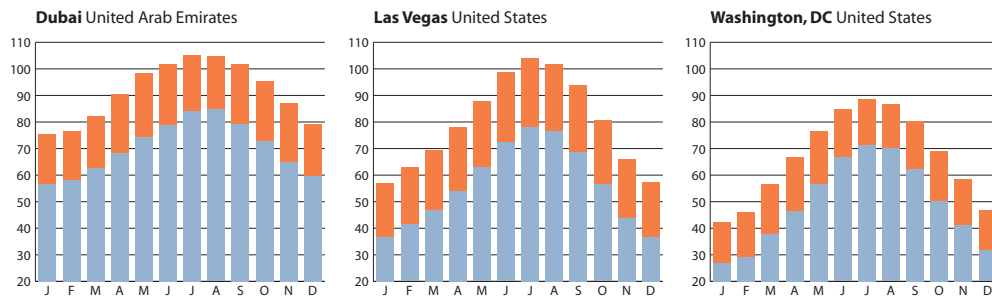
Figure 10. Sun path diagram for Dubai, a subtropical hot-humid climate at 25°N latitude.

December through March are the most pleasant months, in which one can comfortably walk outside at any time of day. Spring and fall high temperatures often exceed 90°F, and in the summer the city feels like a sauna, with temperatures well over 100°F and humidity exceeding 50%. Precipitation is low during winter and virtually nonexistent in summer.

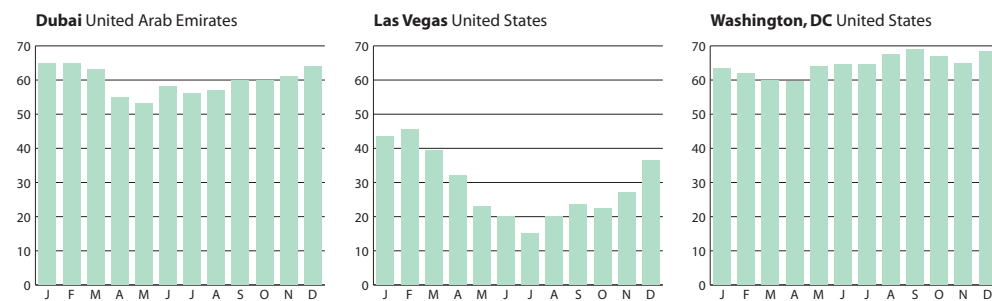
Dubai's harsh climate does not compare with that of any U.S. city; it combines the extreme heat of Las Vegas and the high humidity of Washington, DC [Fig. 11]. Energy-intensive mechanical cooling is a necessary adaptation for living in this climate, but it can be supplemented by passive strategies, particularly extensive shading and natural ventilation. However, evaporative and nighttime cooling strategies are not effective because of high humidity.

In fall, winter and spring, cooling breezes blow off the Gulf during the day; the pattern reverses at night, bringing warmer air from the desert [Fig. 12]. These breezes can be directed and channeled to ventilate streets, public spaces and buildings. In late summer, the prevailing daytime wind direction changes, bringing overheated air and sand in from the desert. Wide, straight streets are a liability during sandstorms, because they serve as chutes for windblown debris. To mitigate this problem, the widest streets in an urban design should incorporate direction changes or curves.

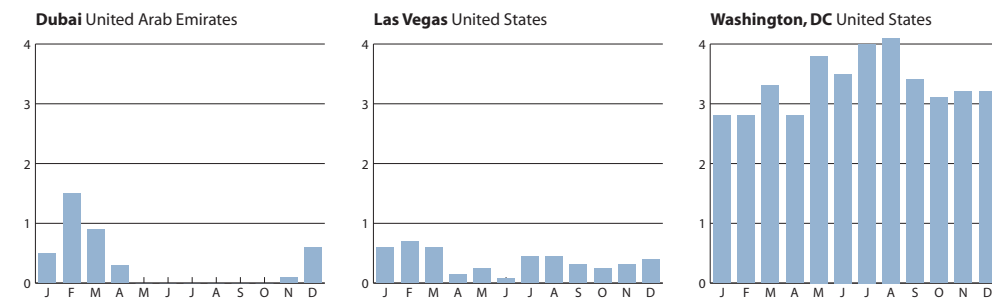
High and Low Temperatures (°F)



Relative Humidity (%)



Precipitation (in)



Wind Speed (km/hr)

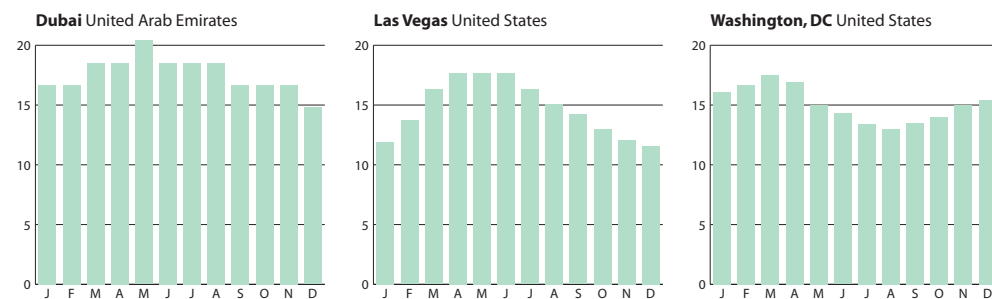


Figure 11. Comparative climate data for Dubai, Las Vegas and Washington, DC.

Prevailing Wind Direction

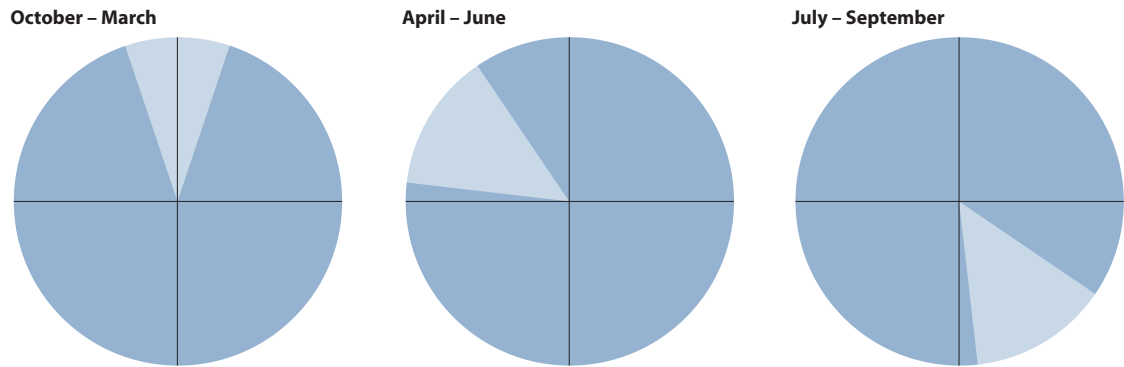


Figure 12. For most of the year, cooling daytime breezes blow in from the Gulf, but in late summer the pattern reverses, bringing overheated air and airborne sand from the inland desert.

Because mechanical cooling is a fact of life in this climate, the thesis design incorporates air-conditioned zones in many public streets and spaces. However, air conditioning is not the only climate strategy available. By modulating street widths and depths, building masses, block and building orientation, and architectural and landscape responses, the urban design can extend the comfortable outdoor season from four months to six or more, and reduce discomfort during the hottest months.

Site Orientation and Context

Site selection was based on a review of planned and completed station locations on the Dubai Metro Red Line, which parallels Sheikh Zayed Road and the Gulf coast [Fig. 13]. The first public rail transit system in the Gulf region, Dubai Metro is the

fastest-built system of its size in history (construction began in 2006 and the first stations opened in 2009). Most stations serve existing developments and neighborhoods, but on the western fringes of the city the Metro has outpaced real estate development, resulting in stations that deposit passengers in the desert.

The most obvious example of this is the Nakheel Harbour & Tower Station, the westernmost station open on the Red Line as of January 2010 [Fig. 14]. Beyond the station and attached parking garage, there is nothing there—no harbour, no tower. The station bridges Sheikh Zayed Road (SZR), a limited-access highway with six lanes in each direction. The Red Line connects passengers from this terminal to Dubai Marina, Dubai Mall, Business Bay, Downtown Burj Khalifa and the historic city center. Station entrances on both sides of SZR are served by one-way access roads. A seven-story, 3,000-space parking garage is located on the east side of the station and is directly connected by an enclosed, air-conditioned bridge.

A large, air-conditioned bus waiting room on the ground level of the garage is directly adjacent to a curbside bus lane. Bus service connects the station with Ibn Battuta Mall, a major shopping center, and middle-class housing developments south of the mall. The garage attracts commuters from outlying areas and day-trippers from Abu Dhabi, who can avoid the congestion and

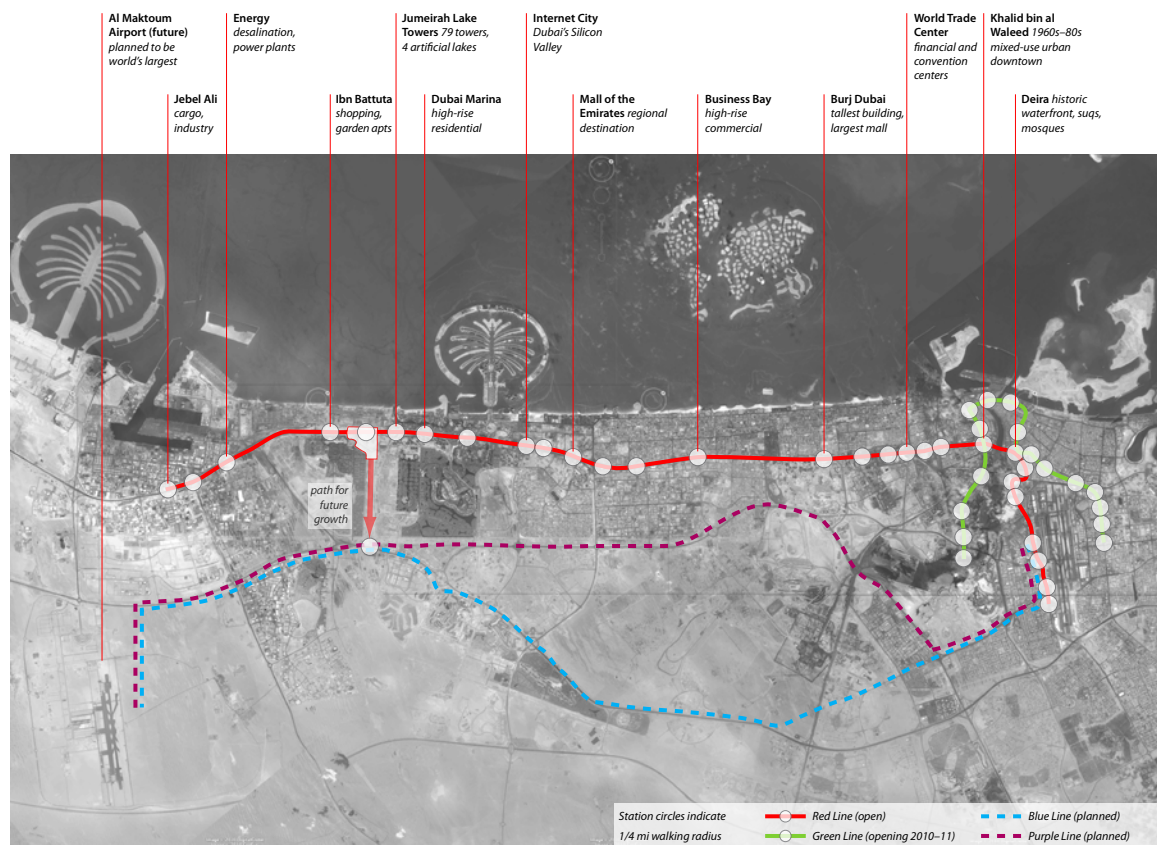


Figure 13. The Dubai Metro system, the Gulf region's first rail transit system, is opening in stages. The Red Line, running parallel to Sheikh Zayed Road for much of its length, was the first line completed.



Figure 14. Left: view to the northeast from pedestrian bridge, Nakheel Harbour and Tower Metro station. Right: view inside the station.

tolls associated with driving by taking the train the rest of the way to their destination in Dubai.⁵

The site [Figs. 15, 16 and 17] is essentially flat, and the soil is coarse, sandy and high in lime and salt. Comparable sites in Dubai have been developed with high-rise buildings using deep pile foundations. The site has been disturbed by initial foundation work for the Nakheel tower. Native vegetation is limited to isolated patches of desert grasses and brush.

Water, gas, electricity and telecommunications utilities are readily available at the site. Most of Dubai's fresh water comes from the nearby desalinization plants, with a small portion coming from treated wastewater. Natural aquifers have been substantially depleted and are not a reliable water source.

To the north and east are views of Dubai Marina, Jumeirah Lakes Towers and Business Bay—all high-rise residential and commercial developments served by SZR and the Metro. West of the site is Ibn Battuta Mall, a sprawling shopping complex with a grocery store, gym, banks, cell phone stores, salons, restaurants and jewelry and apparel shopping. Phase Two of Ibn Battuta, a mall expansion with adjacent high-rise apartment housing, is planned for a site northeast of the original mall complex.

5 Accessed Dec. 13, 2010. <http://gulfnews.com/news/gulf/uae/on-the-quick-track-from-abu-dhabi-1.504441>.



Figure 15. Site in city context.



Figure 16. Site in local context.



site panorama (photographs by Imre Solt, <http://harbourtower.blogspot.com/>, panorama by author)



bird's-eye view including site



view from Metro train

Figure 17. Site views.

To the southwest, Discovery Gardens is a large complex of mid-rise garden-style apartment buildings. Southeast of the site is Jumeirah Islands, a housing development of luxury villas situated in an irrigated golf-course-style environment, complete with artificial lakes. North of the site, between SZR and the Gulf, is a fenced complex containing natural-gas-powered desalination and power plants that serve much of Dubai. Tall power lines from the plants travel southeast along the east edge of the site. (I assume that these lines can be buried.)

Site access is by highway (Sheikh Zayed Road), Metro bus and rail. Using rail, personal automobile or taxi, one can reach the site in approximately 30 minutes from the historic city center, or 15 minutes from “Downtown Burj Khalifa,” the new neighborhood at the foot of the world’s tallest tower. Buses also serve the area, but take much longer due to frequent stops.

Nakheel Harbour & Tower Masterplan

The Metro station’s name, Nakheel Harbour & Tower, now reads as an example of Dubai’s hubris because there is neither a tower nor a harbour at the site—there is only an abandoned construction site. On one recently-published map, the name was changed to Jumeirah Islands, after a single-family housing development one mile to the southeast.

Nakheel Harbour & Tower was a multibillion-dollar, 150-hectare (0.6 sq mi) development planned for a swath of land extending from SZR to the southeast (including the site for this thesis) [Fig. 18]. The Arabian Canal, a mega-project intended to create waterfront real estate deep in the desert [Fig. 19], was to bisect the site. Nakheel, a prominent state-sponsored developer, announced the development in late 2008, declaring that it would become the new “unofficial capital of Dubai.”

The centerpiece of the development was the Nakheel Tower, a kilometer-high structure that would outrank the 800-meter Burj Khalifa, completed in 2010, as the world’s tallest building. With a massive convention center at its base, the tower was to house hotels, apartments and offices. Flanking the tower were to be 40 smaller towers of 20 to 90 stories and the world’s largest inland marina [Fig. 20]. Surrounding the central superblock, residential and office towers were laid out in smaller blocks intended to promote walkability.

The Nakheel masterplan called for 1.5 million sq m of real estate, including 250,000 sq m of hotels and hospitality space, 100,000 sq m of retail space and large expanses of open green space (made possible by significant irrigation).⁶ More than 55,000 people were projected to live in the completed development in

⁶ Accessed Dec. 13, 2010. <http://www.cityscapeglobal.com/PDF/dailynews08/CSDubai-Day-one.pdf>.

19,000 apartments, with an additional 45,000 commuting in for work, shopping and events. However, in 2009, because of falling oil prices and the collapse of the speculative real estate market worldwide, the development was put on hold indefinitely. Preliminary foundation work for the tower is the only evidence of the abandoned plans for the site. Work on the Arabian Canal was begun offsite, but that project has also been abandoned.

The thesis design critiques, revises and repackages the Nakheel “towers in the park” masterplan. Alternatives to energy-intensive skyscrapers, such as mid-rise courtyard buildings, may be more efficient, comfortable and affordable, but can they accommodate the same density? In light of the changed economy and mounting evidence that Dubai needs alternatives to toxic sprawl, the site masterplan begs for speculation and redesign.



Figure 18. Nakheel Harbour and Tower masterplan in context.

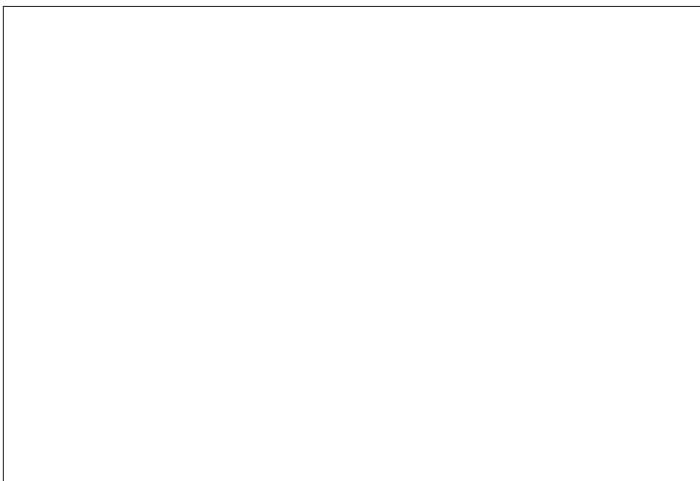


Figure 19. Arabian Canal masterplan. Accessed Feb. 15, 2010. <http://www.nakheelharbour.com>.

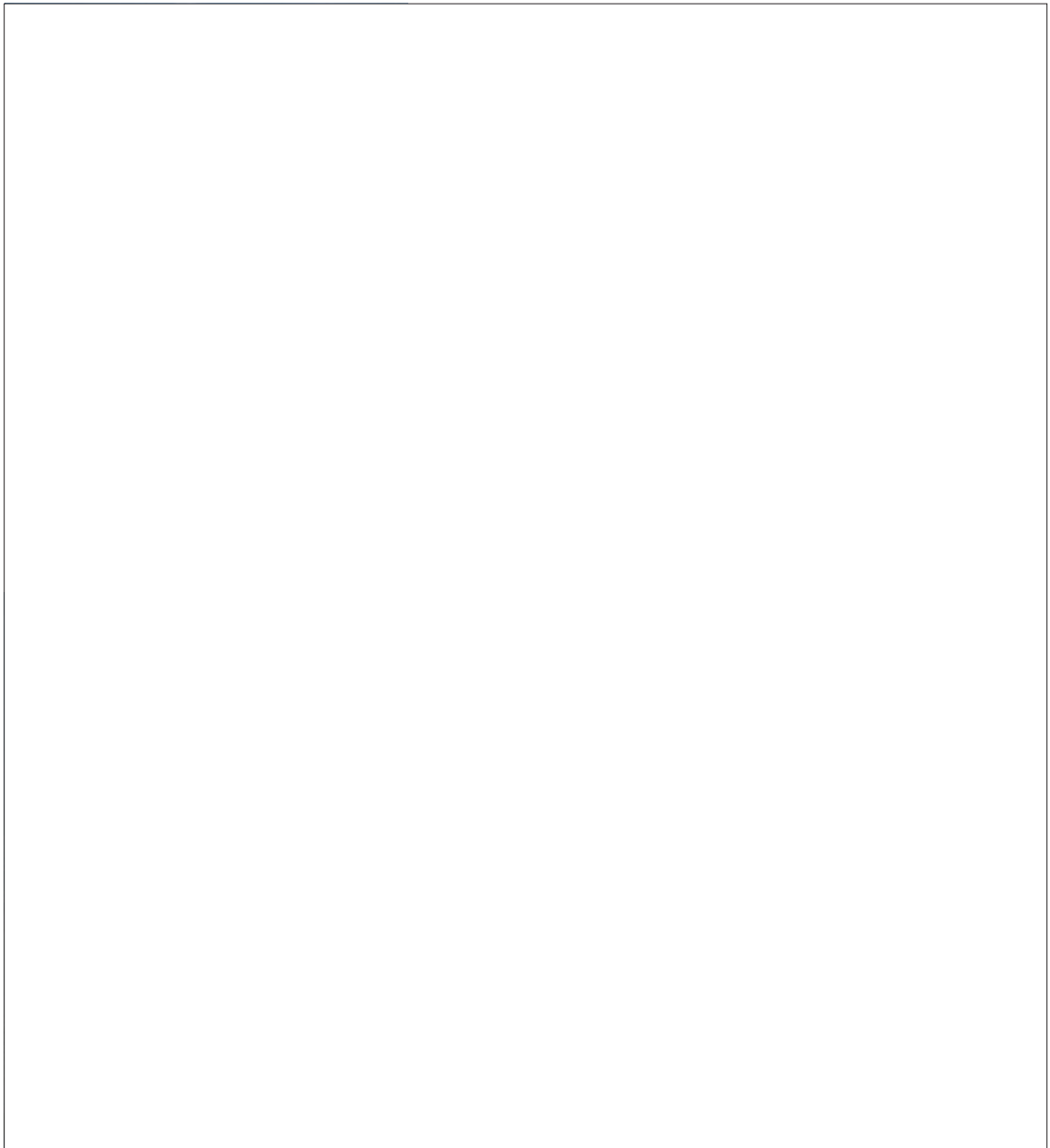


Figure 20. Architects' renderings of the Nakheel Harbour and Tower masterplan. Accessed Feb. 15, 2010.
<http://www.nakheelharbour.com>.

Chapter 3: Precedents + Principles

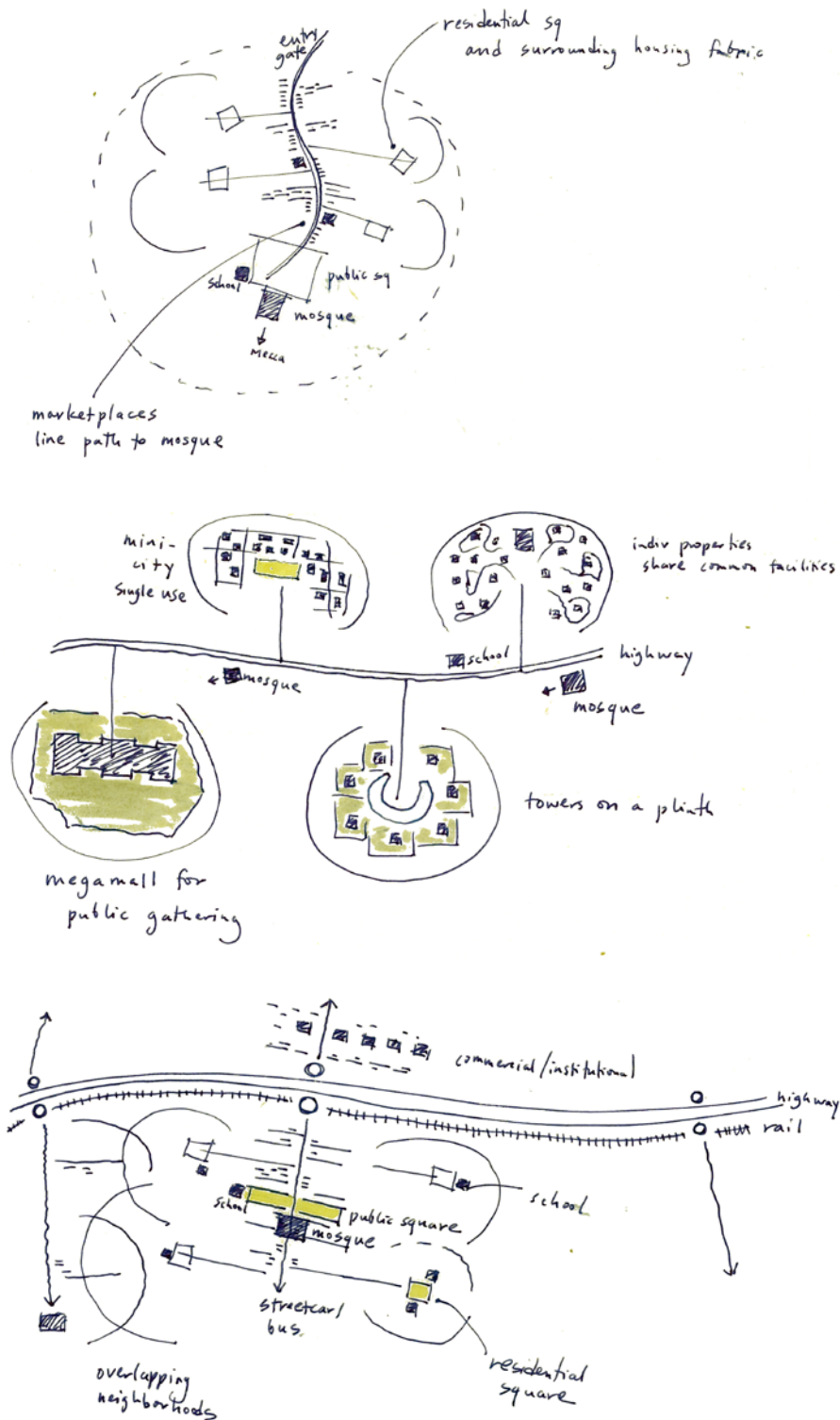


Figure 21. Analytical urban development diagrams. Top: traditional Arabic-Islamic city. Middle: contemporary Dubai. Bottom: proposed hybrid of traditional and contemporary settlement patterns.

Viewed holistically, sustainable urbanism integrates not only environmental performance but also cultural, social and economic health. Even in a place as new as Dubai, there are lessons to be learned from history. Of course, there is much to learn from the present—contemporary architects have been doing significant work in the Gulf states for decades.

Traditional Arabic-Islamic Cities

Arabic-Islamic cities share common physical characteristics that have both cultural and climatic components.⁷ Chief among these:

- Important public spaces (the city gate, the mosque, the neighborhood square) are connected not necessarily by axes or views, but rather by continuous sequences of positive space (covered streets, arcades, suqs).
- The courtyard building type is favored because it creates shaded, private open space, maximizes lot coverage and forms clear street edges.
- People of different income and class levels live next to one another; house size, not building type or neighborhood, indicates status.

⁷ Hakim 165-71.

- Access to fresh air and wind must be protected for each home.
- The private domain must be visually separated from the public domain.
- Beauty is achieved without arrogance: decorative texts and patterns are used instead of figural representations.
- Only important public entrances receive elaborate facades; otherwise, exterior surfaces are modest in appearance. Interior walls, which are never visible from the street, are often richly decorated.
- Small public squares reinforce neighborhood cores [Fig. 22].
- Water, a precious resource, is celebrated via public wells, fountains and paradise gardens.
- Every town has at least one suq, a covered shopping street, where people can pick up daily essentials [Fig. 23].

Contemporary Sustainable Urbanism

The Arabian Peninsula is rich with oil and natural gas deposits that the rest of the world has gladly consumed, at ever-increasing prices. It is widely predicted, however, that the world's petroleum addiction, continuing urbanization and accelerating climate change will eventually lead to a worldwide energy crisis.



Figure 22. Neighborhood squares are nodes for commercial, social and religious life; they also provide relief from the dense texture of the traditional city.



Figure 23. The suq's open, repetitive roof structure transforms a street into a linear outdoor room.

According to Shahswar G. Al Balushi of the Urban Land Institute's Middle East satellite center, the UAE "is the first major hydro-carbon-producing nation to take a leadership position in clean energy and sustainable development."⁸

This leadership, so far, is characterized more by good intentions than by actions. Green building is encouraged but not financially incentivized. Oil and gas are cheap and abundant, so there is little tangible benefit to investing in renewable energy. During my visit, I didn't see a single solar panel in Dubai—in spite of the fact that the skies are sunny 360 days a year.

In the same visit I attended the Dubai Forum, a high-profile symposium on sustainable development held in conjunction with the opening celebration of the Burj Khalifa. The tower, the world's tallest, was celebrated as an example of sustainability because it sends a message that Dubai's economy is still going strong, not because it is a particularly green building. Siphoning off condensed water from the huge air conditioning plant to irrigate outdoor landscaping, for example, does not make the project sustainable as a whole.

However, there are signs of change in the region. Abu Dhabi, the UAE's capital city, positions itself in many ways as the anti-Dubai. The government's new Estidama sustainability pro-

8 "ULI Middle East Centre," *Urban Land Middle East* 23.

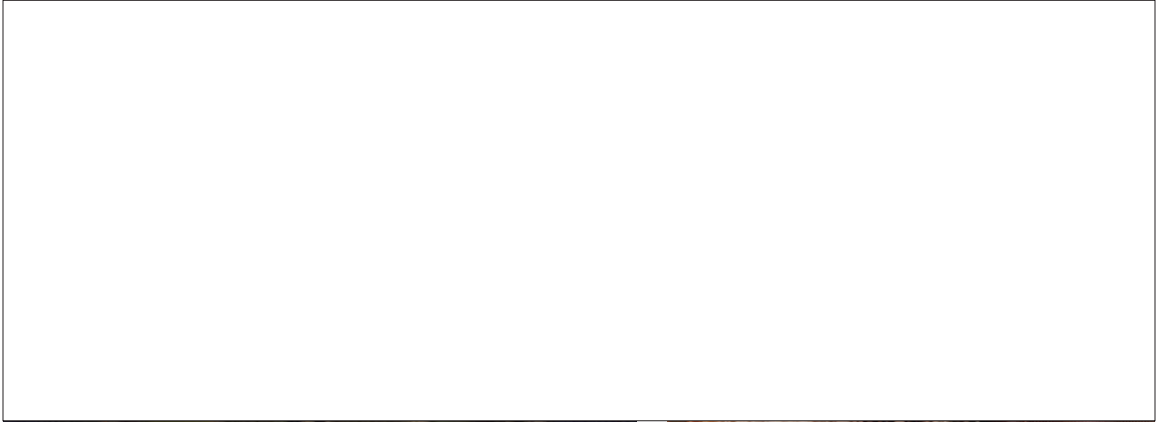


Figure 24. Masdar City is envisioned as a self-contained, net-zero settlement. Accessed Dec. 13, 2010, <http://inhabitat.com/plans-unveiled-for-worlds-first-zero-carbon-zero-waste-city-masdar-city/>.

gram is generally modeled after the North American LEED rating system and tailored to local conditions. For example, the Estidama guidelines discourage glass curtain-wall structures in favor of “traditional materials and fenestration patterns” and “landscape forms that use less water or reuse water,” and they promote the use of natural breezes for ventilation.⁹

On the outskirts of Abu Dhabi, construction is underway for Masdar City, a futuristic experiment in net-zero urbanism [Fig. 24]: “Launched with great fanfare in 2006, the Masdar Initiative... includes plans for a world-class research university modeled on the Massachusetts Institute of Technology, as well as high-tech corporate tenants and venture capitalists.”¹⁰ However, the Foster and Partners masterplan is now being scaled back, and the build-

⁹ Langdon 7.

¹⁰ Jenny Mandel, “Financial Woes Crimp Celebrated Middle East ‘Green City,’” *Greenwire*. Accessed March 17, 2010. <http://www.nytimes.com/gwire/2010/03/17/17greenwire-financial-woes-crimp-celebrated-middle-east-gr-91007.html>.

ers have conceded that the development will, in fact, need to draw power from the city grid. While Masdar City is an important example of experimental sustainable design in the Gulf region, I question its conceptual and physical separation from the city of Abu Dhabi. Its physical form, a perfect square elevated two stories above the desert floor, perpetuates the paradigm of inward-looking developments that don't relate to their surroundings.

The American University of Cairo's new campus, opened in 2008, is one of the first explicitly "sustainable" large-scale projects completed in the region. Architect Abdel Halim Ibrahim, an Aga Khan Award winner, worked with Sasaki Associates to develop campus design guidelines. A key design goal was to reduce campus energy needs by 40 percent by creating environmentally comfortable outdoor public squares and pathways [Fig. 25]. The designers achieved this with a microclimate strategy—using shaded courtyards as high-pressure "containers" for cool air, connected by arcades ("tunnels") to open, low-pressure "fields" that expel hot air to the atmosphere.¹¹ The open fields are planted with deciduous trees that provide shade along circulation paths in summer and allow solar heating in the cooler winter months.

Contemporary sustainable design on the urban scale is rare in the Gulf states, but on the smaller scale of buildings, many

11 Asfour, Khaled. "Green Lights Blink in Cairo." *Urban Land Middle East* 69.

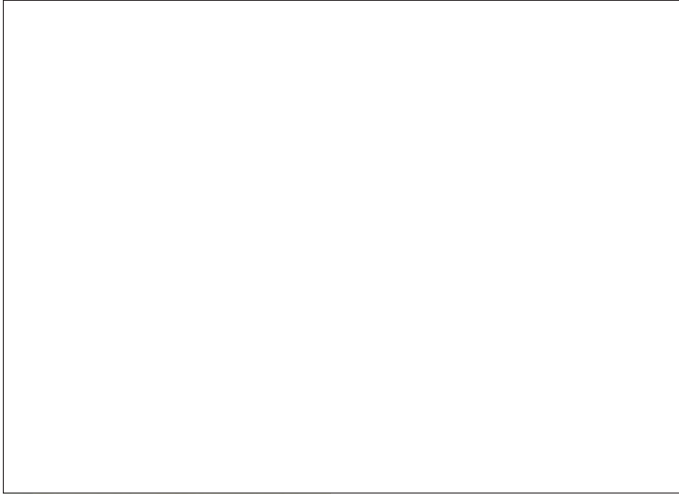


Figure 25. The American University of Cairo campus.

Left: accessed Dec. 13, 2010. http://farm3.static.flickr.com/2575/3718488522_62b0fe9dde_b.jpg.

Right: accessed Dec. 13, 2010. <http://global.tulane.edu/studyabroad/programs/images/cairoAUC.jpg>.

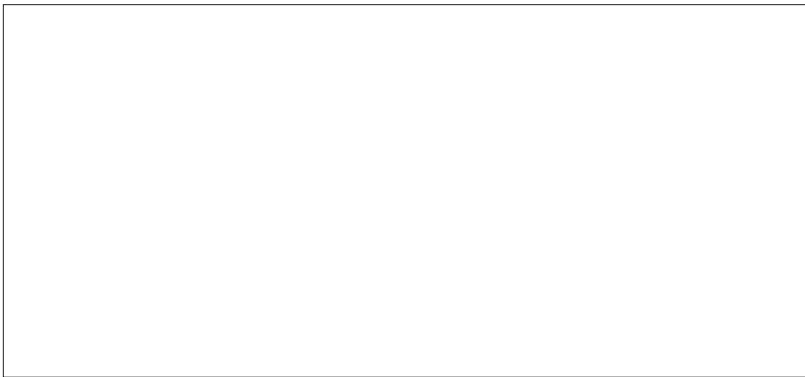


Figure 26. SOM's Hajj Terminal in Jeddah exemplifies culturally-specific design for public space. Accessed Dec. 13, 2010. http://www.som.com/content.cfm/king_abdul_aziz_international_airport_hajj_terminal.

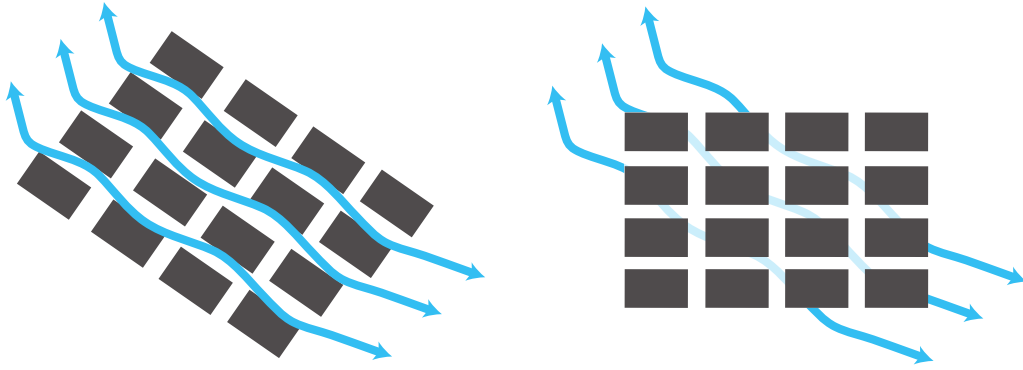
examples of thoughtful environmental response exist. One of the most notable is the 1981 Hajj airport terminal in Jeddah, Saudi Arabia, designed by Skidmore Owings Merrill [Fig. 26]. A large, open-air structure, the design was inspired by the tents traditionally used by pilgrims traveling through the Arabian Desert to Mecca. The white fabric roof reflects solar radiation and provides continuous shade, and air circulation is enhanced by vents at the top of each "tentpole" column. The AIA 25-Year Award jury

lauded the project for its site and cultural specificity: “The terminal presents a sense of place, ecology, economy of means, and culture—not imposing on but learning from the local culture and environment.”¹²

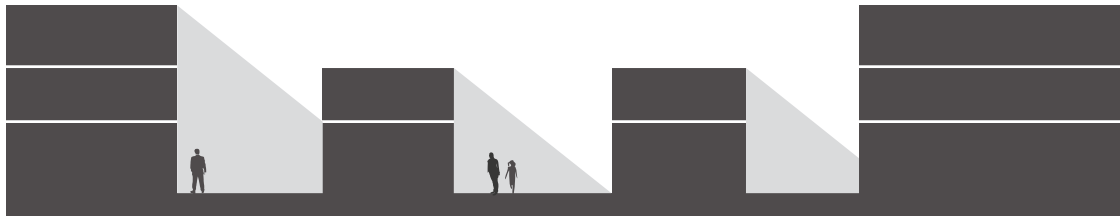
Urban Design Principles + Strategies

Drawing from both traditional and contemporary precedents, I formulated general principles for urban design, landscape and architecture as a beginning to the thesis design “kit of parts” [Figs. 27–31]. These principles were integral to the articulation of streets, spaces and buildings in the final design proposal.

12 Accessed Dec. 13, 2010. http://www.som.com/content.cfm/pr_hajj_terminal_wins_prestigious_aia_25_year_award.



design block and building orientation to maximize air circulation, particularly for favorable Gulf breezes



modulate block orientation, building masses and street widths to shade streets and public spaces



provide a hierarchy and diversity of street types to maximize porosity, circulation options and levels of privacy

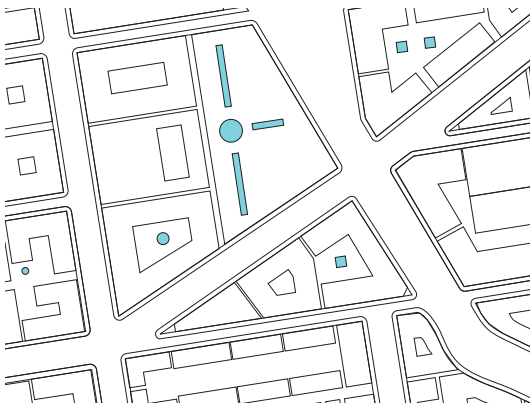
Figure 27. Urban design guidelines.



knit city together with green infrastructure



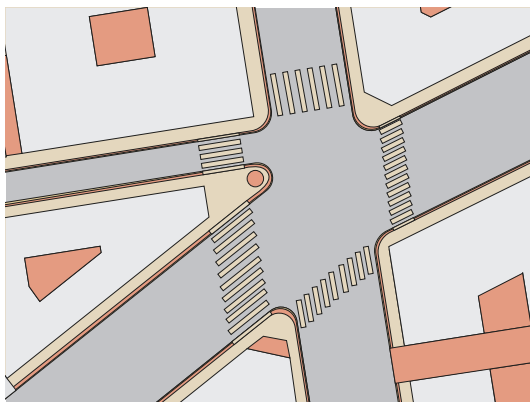
design courtyards as vegetated microclimates



celebrate water as a precious resource with limited, high-impact fountains and pools



reduce irrigation demand with native, drought-resistant plants

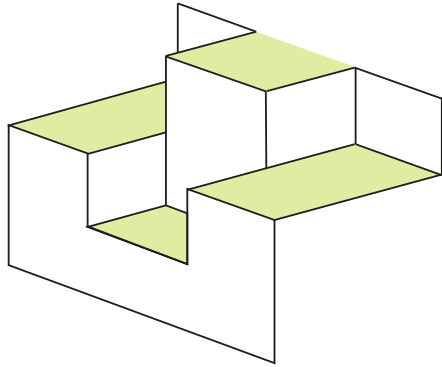


select colorful hardscape materials for contrast and wayfinding

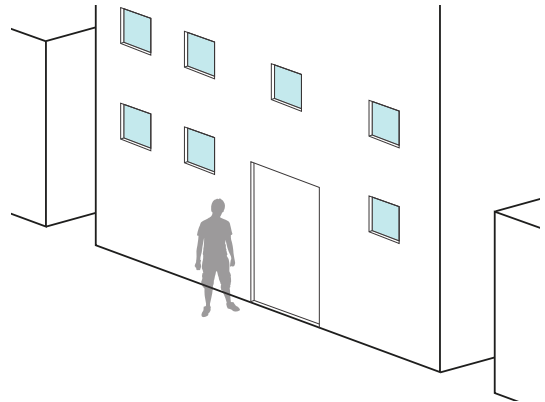


mitigate heat gain with high-albedo surface materials

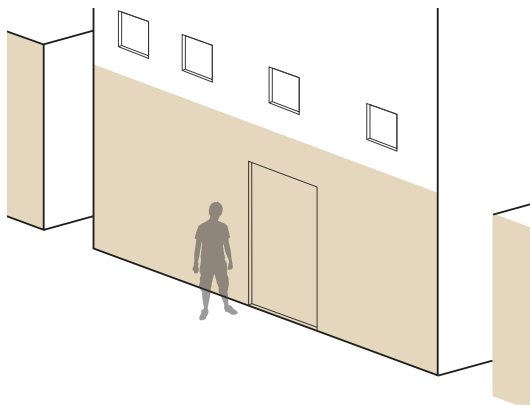
Figure 28. Landscape design guidelines.



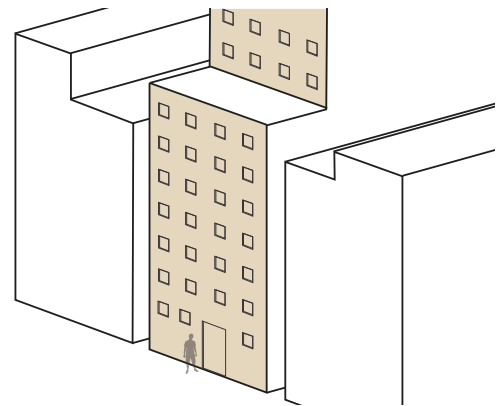
create compact, private, green outdoor spaces with terraces



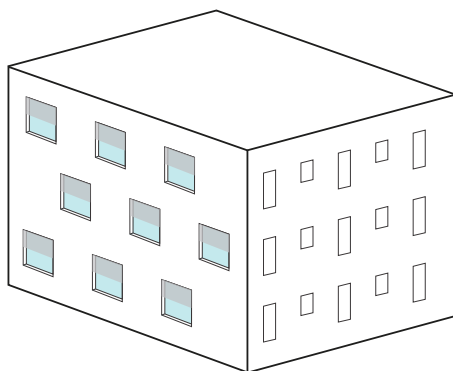
place openings to private space above eye level



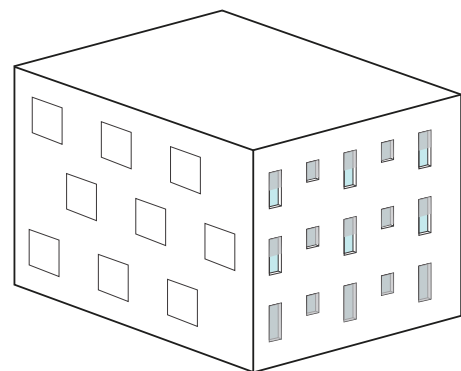
maintain 2.5m+ street wall along 75%+ of frontage



maintain street proportions with setbacks

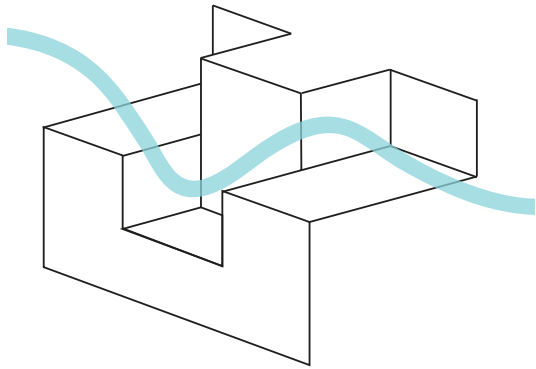


orient large openings and glazing on north-south axis

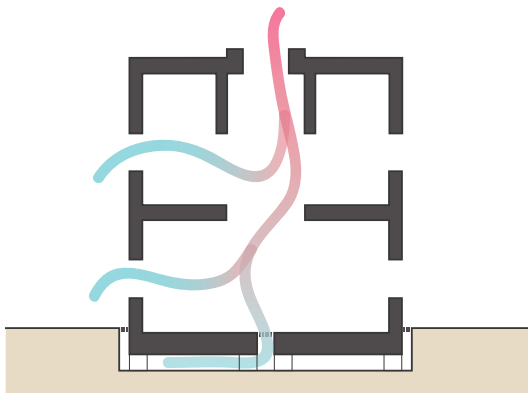


minimize openings on east-west axis

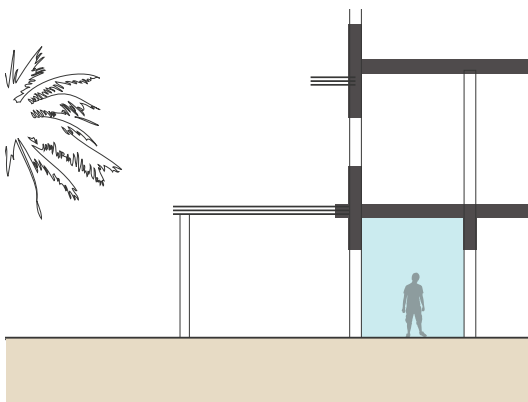
Figure 29a. Architecture design guidelines.



promote air turbulence and movement
with irregular massing

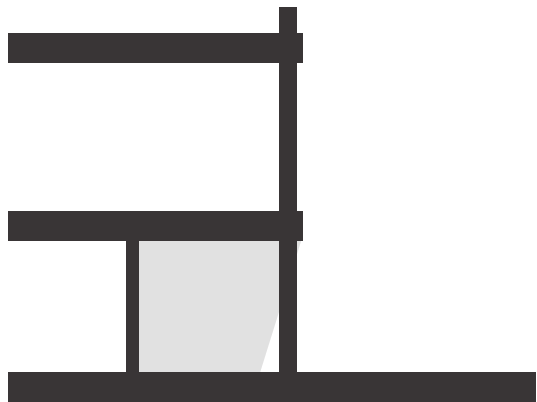


design building sections for cross ventilation
and stack effect

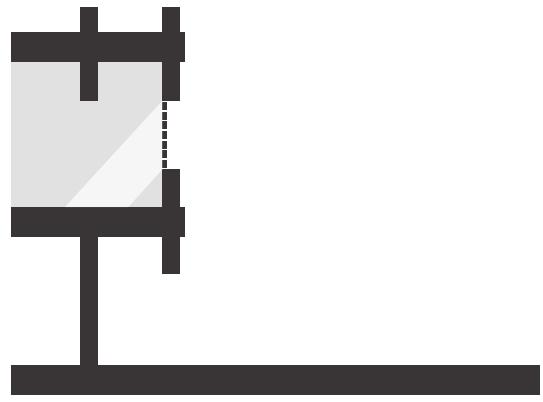


integrate air-conditioned passages into
key pedestrian street sections

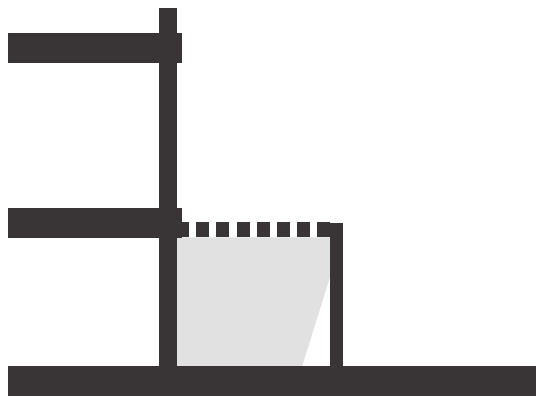
Figure 29b. Architecture design guidelines, continued.



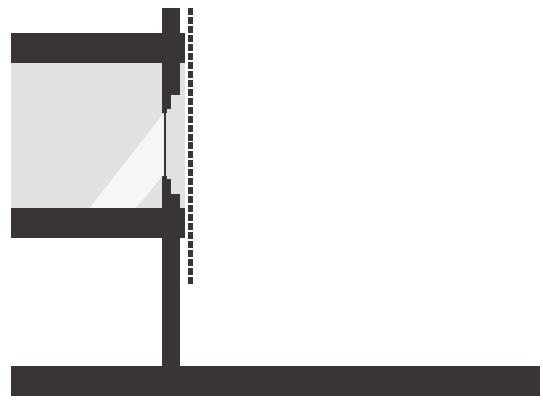
arcade



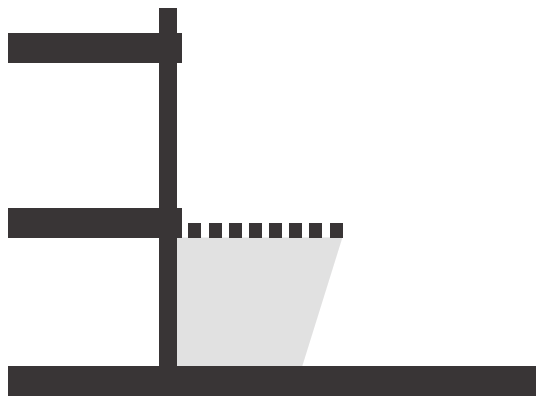
deep facade



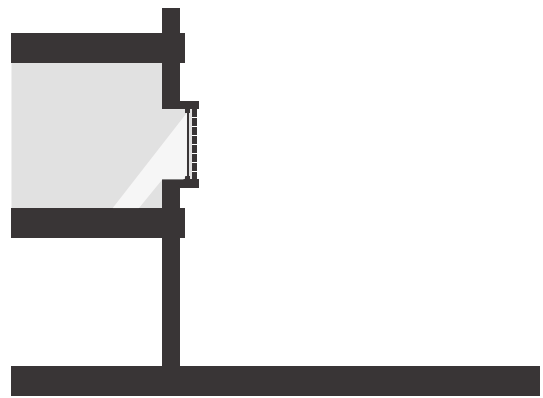
attached loggia



double skin

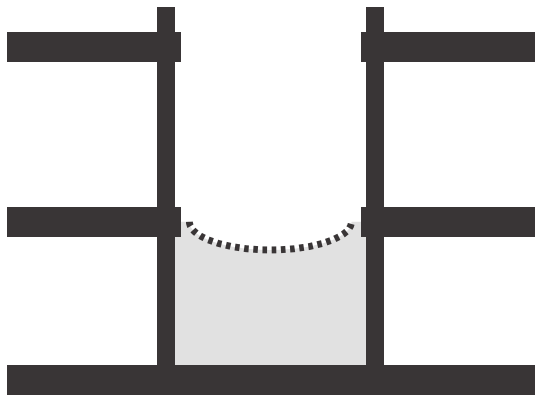


awning

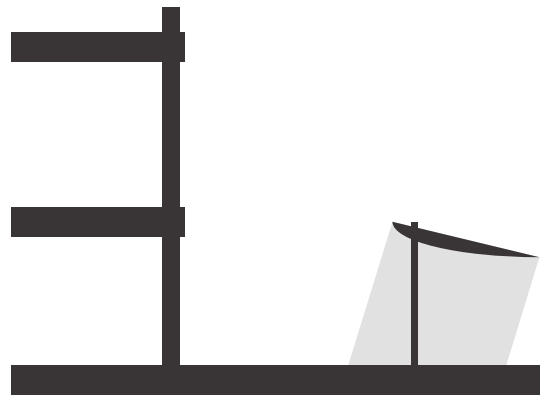


mashrabiya

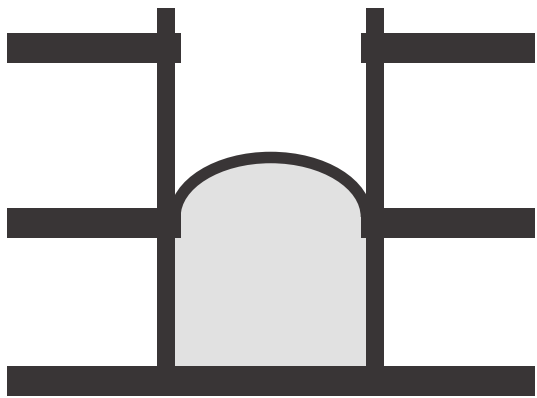
Figure 30a. Shading strategies to integrate in landscape and architectural designs.



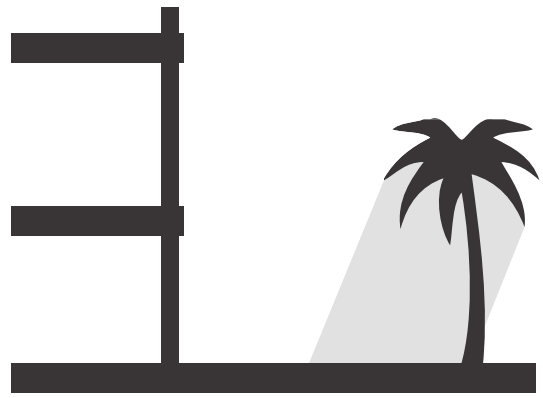
suspension



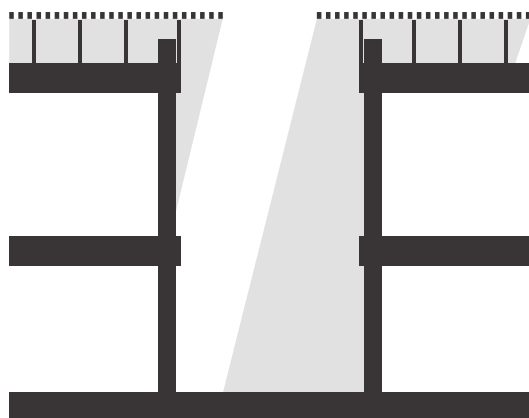
freestanding structure



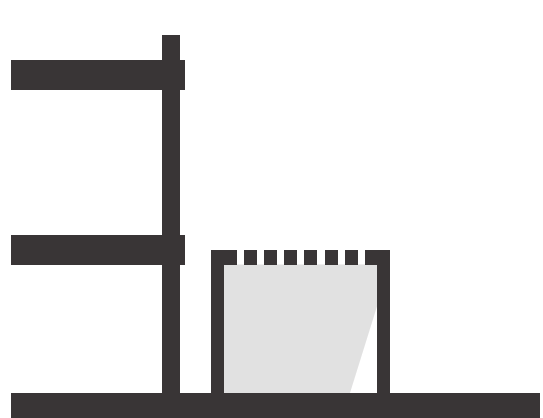
vault



vegetation

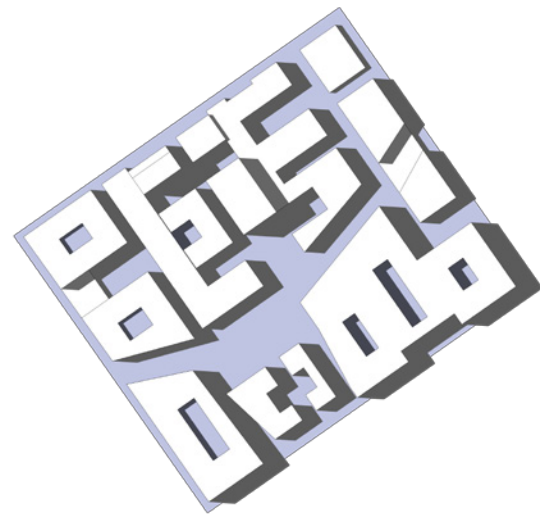
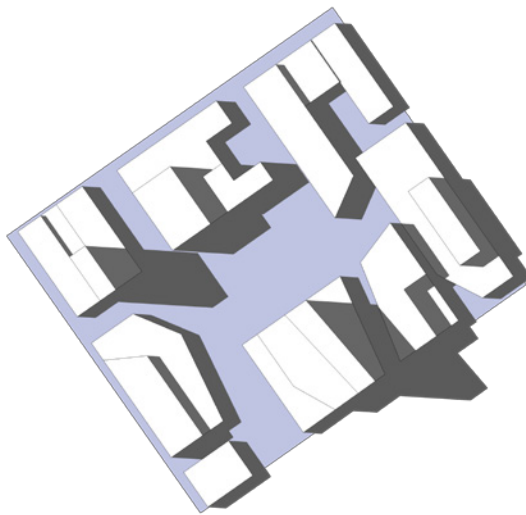
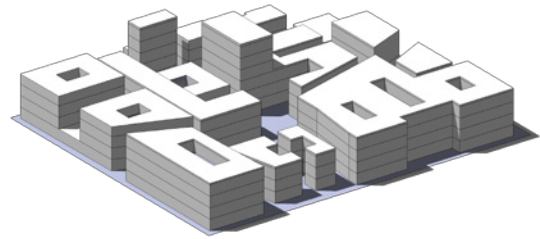
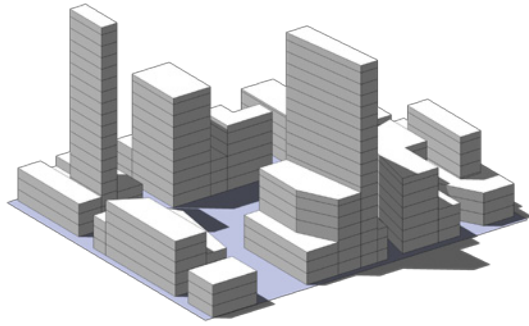


solar panels



freestanding loggia

Figure 30b. Shading strategies to integrate in landscape and architectural designs, continued.



existing masterplan _ “towers in the park”

medium to very high density (FAR 3–20+)

adoption of conventional 20th century Western superblock typology

parking and retail plinths topped by towers

inconsistent massing and building placement dilutes street definition

increased energy demand _ mechanical cooling, ventilation, elevators

proposed _ “holes in the cheese”

medium to high density (FAR 3–10)

reinterpretation of traditional Middle Eastern city layout

courtyard layouts create shaded outdoor streets and spaces

street frontage is consistent, building faces define street character

reduced energy demand _ cross-ventilation, self-shading

Figure 31. Comparative urban form diagram for existing and proposed masterplans.

Chapter 4: Design Process + Product

Design Process

The development of the thesis design, a flexible framework for an alternative urban settlement pattern, was an iterative process of learning through making. Drawings, diagrams, digital and physical models and written narratives were continually discussed, revised and reconsidered. Design processes and products are documented in Figs. 32–45.

The Nakheel Harbour and Tower masterplan covers 150 hectares; in the course of site design I reduced the site area to 100 hectares to ensure that the entire development would be walkable. The central boulevard acts as a spine, bringing people via tram from the Metro station to the neighborhood center. This spine terminates at the edge parkway, but the design suggests that it can be extended as an axis for future development to the southeast.

Street and block orientation are based on prevailing wind patterns and solar exposure. A major cultural orienting device, the direction to Mecca, corresponded at a 90-degree angle to the prevailing wind direction off the Gulf. This convergence of climate and culture provided the cardinal orientation for the development. Avenues running north-south are widened to serve as

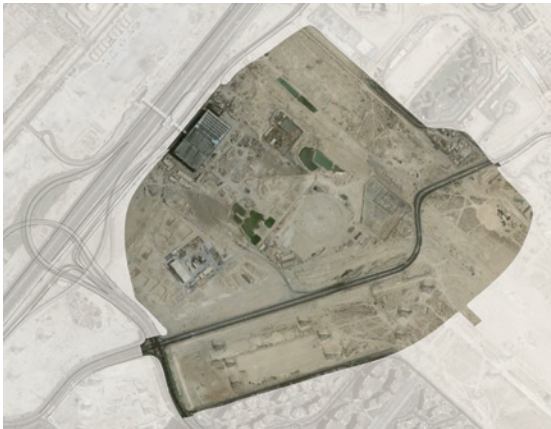
breezeways, continually flushing hot air out and drawing fresh air from the cooler east-west streets and courtyards. East-west streets are narrow to maximize self-shading by buildings, and the urban design guidelines require consistent street walls to ensure shading of sidewalks.

The design of public streets and spaces emphasizes flexible response to climate. For example, the boulevard incorporates both shaded outdoor walkways and air-conditioned interior passages. In winter and the swing seasons, retailers and cafes can spill out onto the street, creating a compelling environment for social exchange. The edge parkway simultaneously encloses the development and connects it to its context, providing recreational and retail amenities for residents of neighboring subdivisions.

Green space and water features are deployed selectively to save water and energy (fresh water comes from oil-powered desalinization plants). Major public streets are lined with native trees, shrubs and flowers, and numerous “pocket parks” serve as relief from the dense urban fabric. Private courtyards provide residents with opportunities to design their own green oases.

The build-out depicted in the final drawings would replace about half the real estate in the Nakheel masterplan (2.5 million sq m vs. 5 million sq m), keeping the proportion of nonresidential vs. residential development similar. However, it would occupy

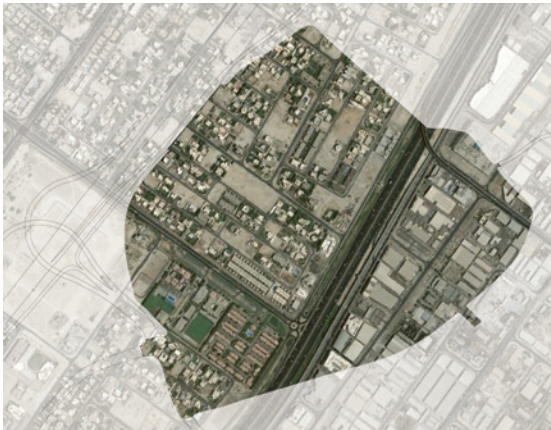
only two-thirds the land area. Because public spaces, streets and buildings are designed to maximize shading and ventilation, overall energy usage would be dramatically lower compared to the Nakheel plan, which is dominated by glazed skyscrapers set far apart from one another.



existing site



Dubai, Deira district (developed 1900–70)



Dubai, Jumeirah district (developed 1970–90)



Isfahan, Iran



Washington, DC



Midtown Manhattan

Figure 32. Scale comparisons with other settlement patterns in Dubai, the Middle East and the U.S.

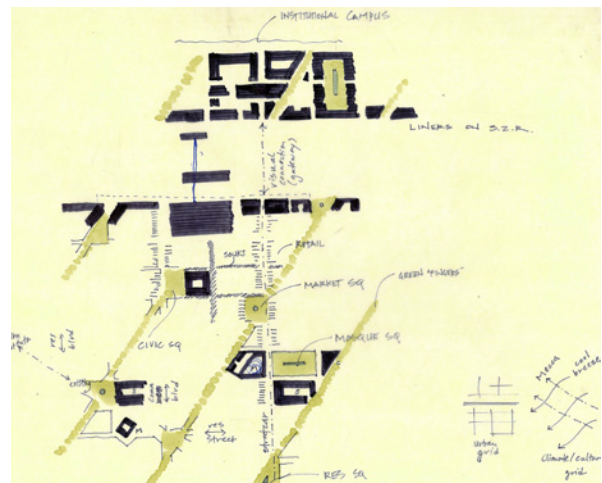
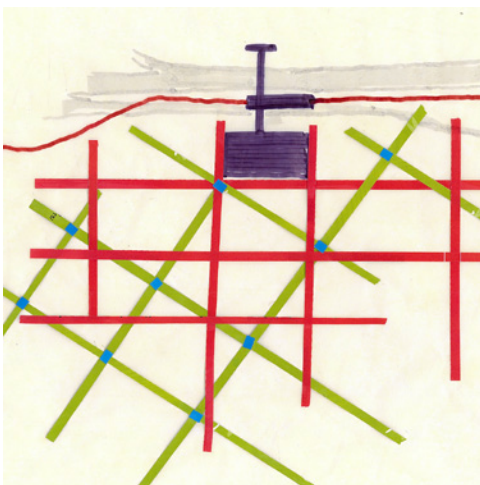
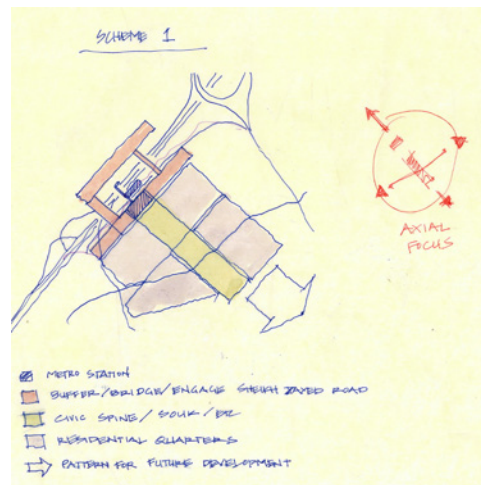
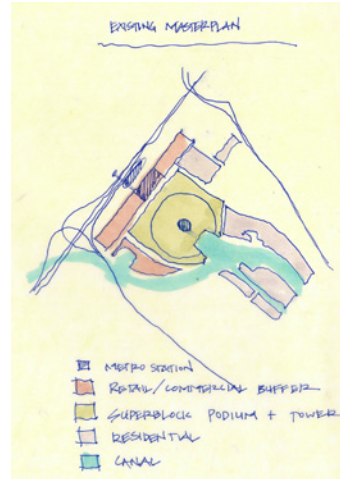
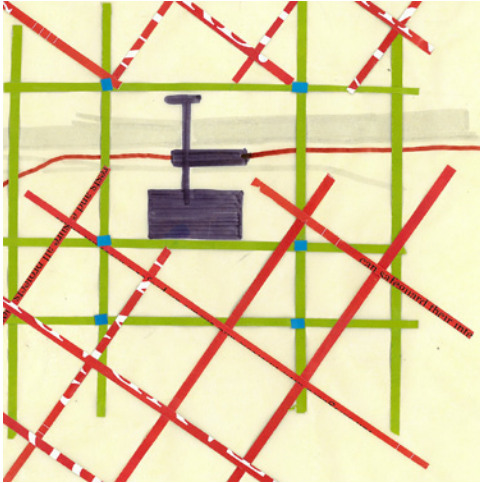


Figure 33. Design process sketches explored options for integrating “green fingers” with an orthogonal street grid.

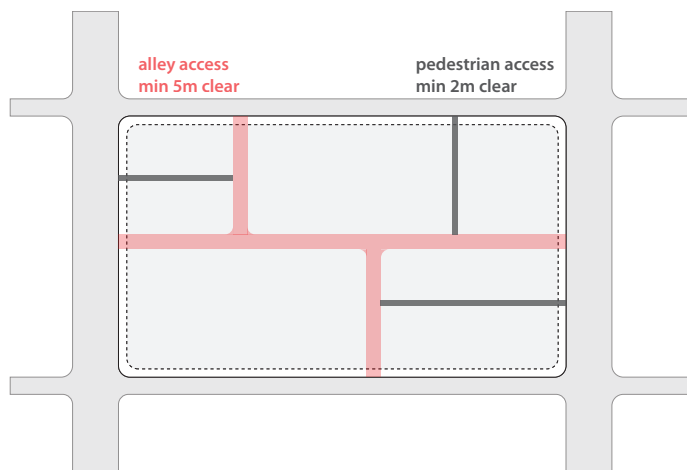
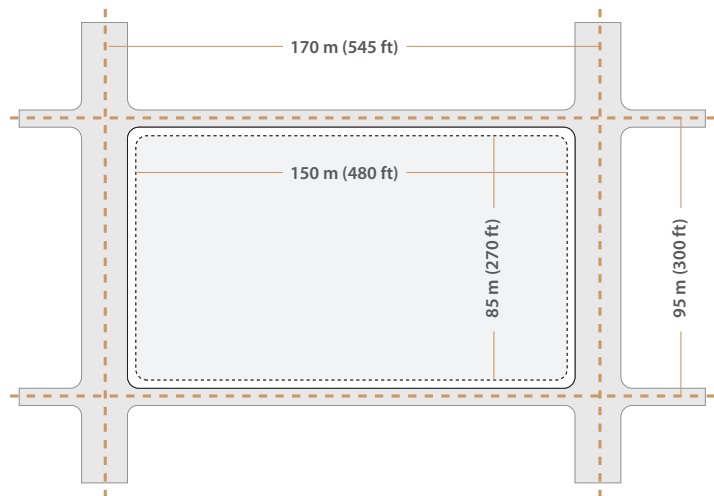
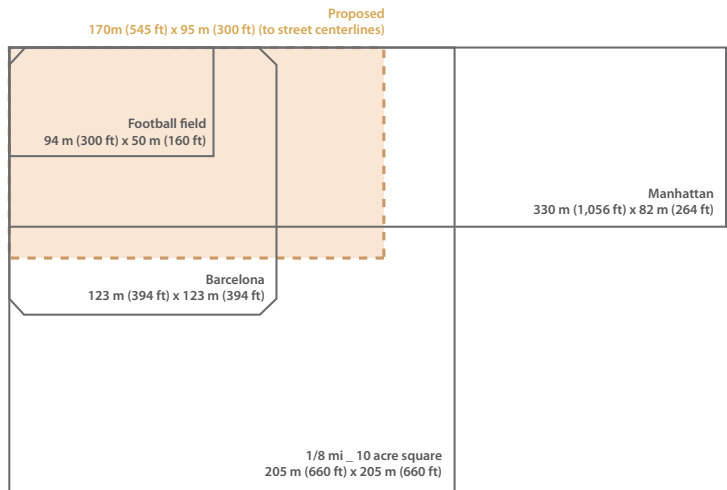


Figure 34. Block dimensions and circulation guidelines.

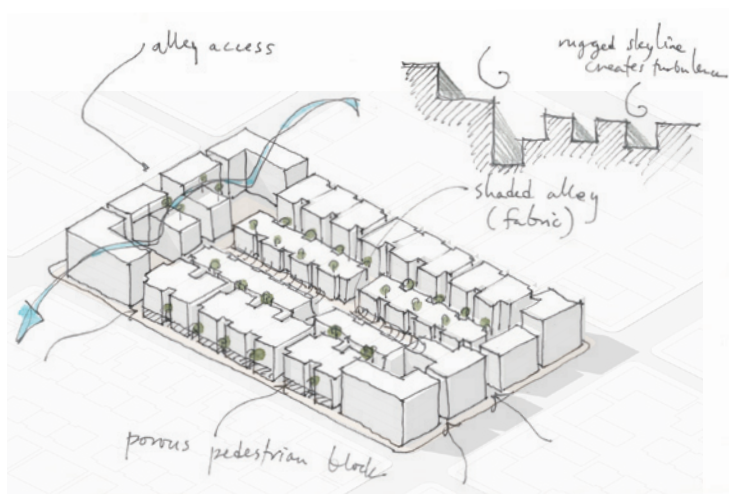
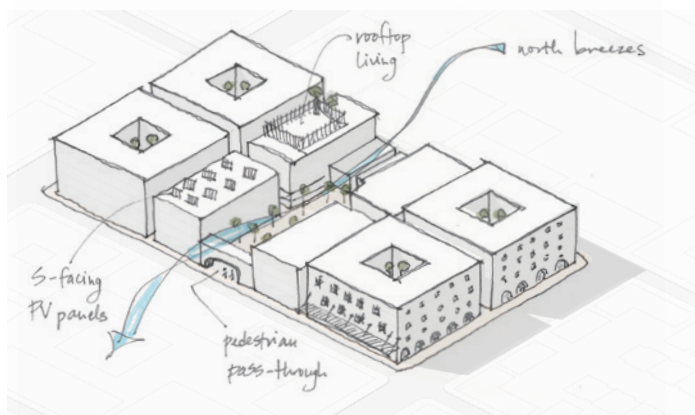
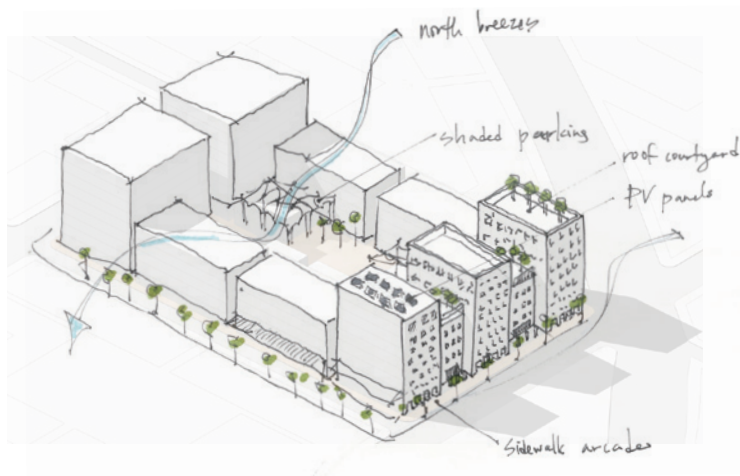


Figure 35. Block massing prototypes. Top: high density. Middle: medium density. Bottom: low density.

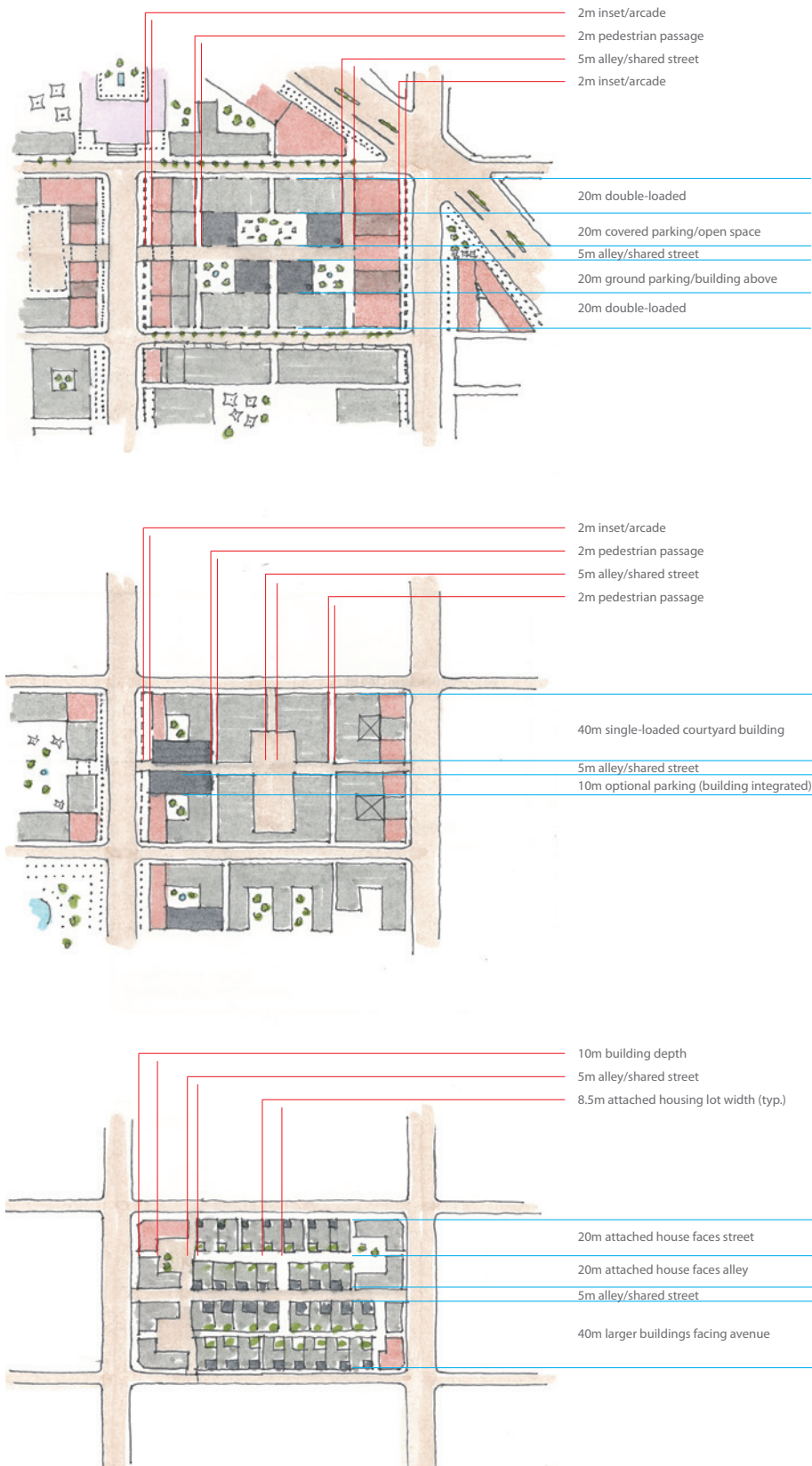
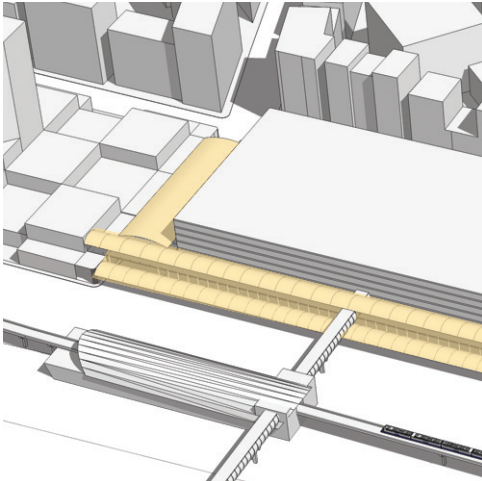
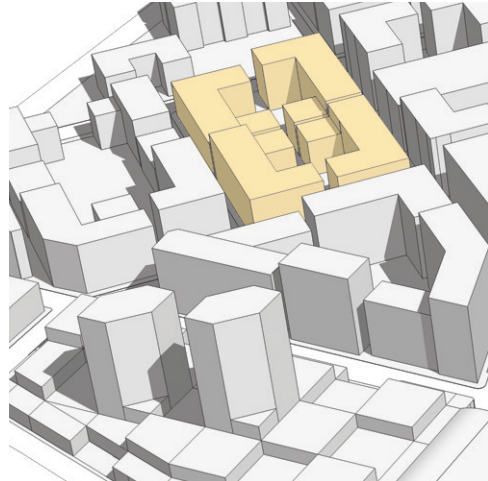


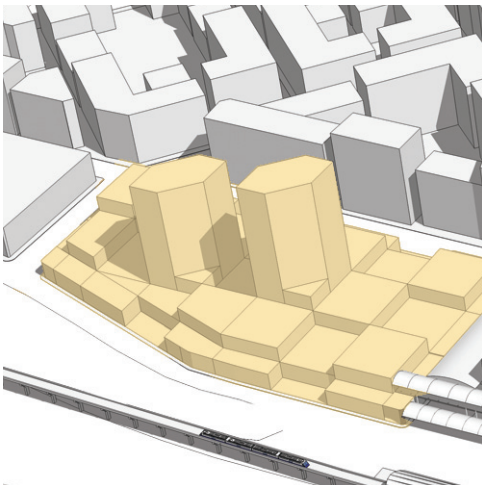
Figure 36. Block layout prototypes. Top: high density. Middle: medium density. Bottom: low density.



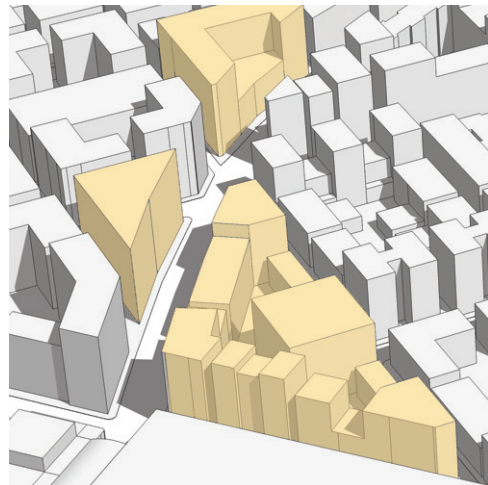
transit "liner" connects Metro station to convention center and boulevard



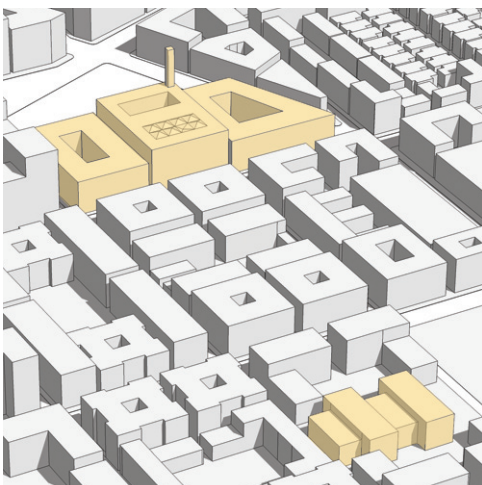
double-loaded mixed-use



convention center/hotel superblock

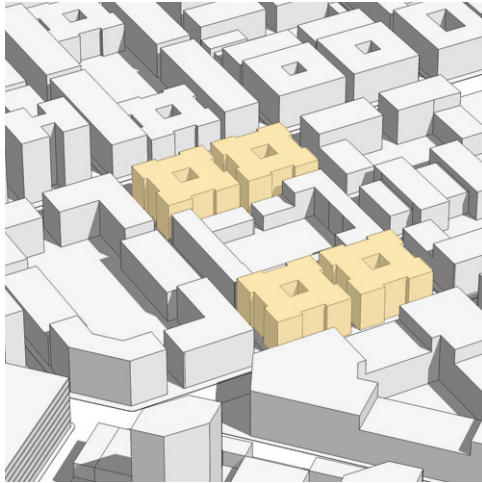


slab and courtyard commercial buildings

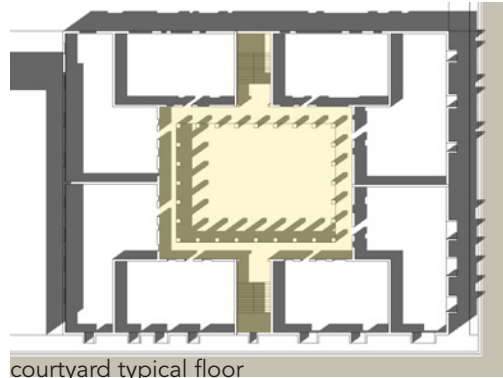


religious/cultural/educational institutions

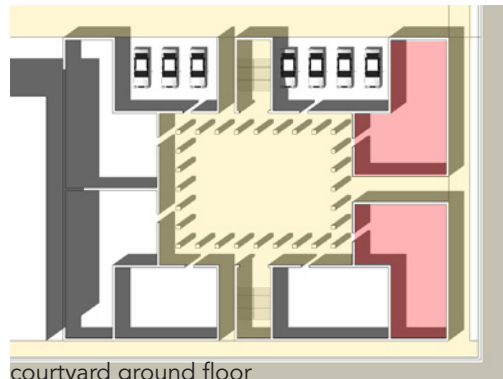
Figure 37. Large-scale building types.



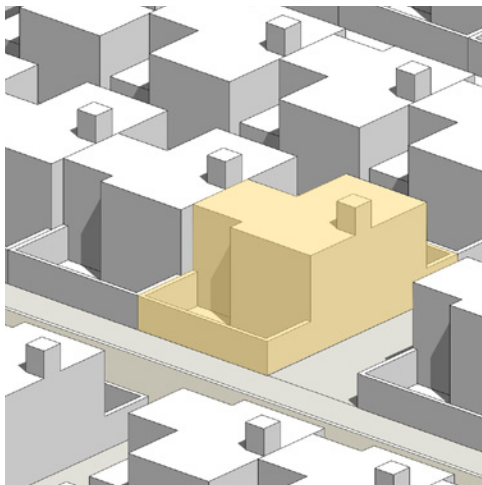
courtyard



courtyard typical floor



courtyard ground floor



attached housing



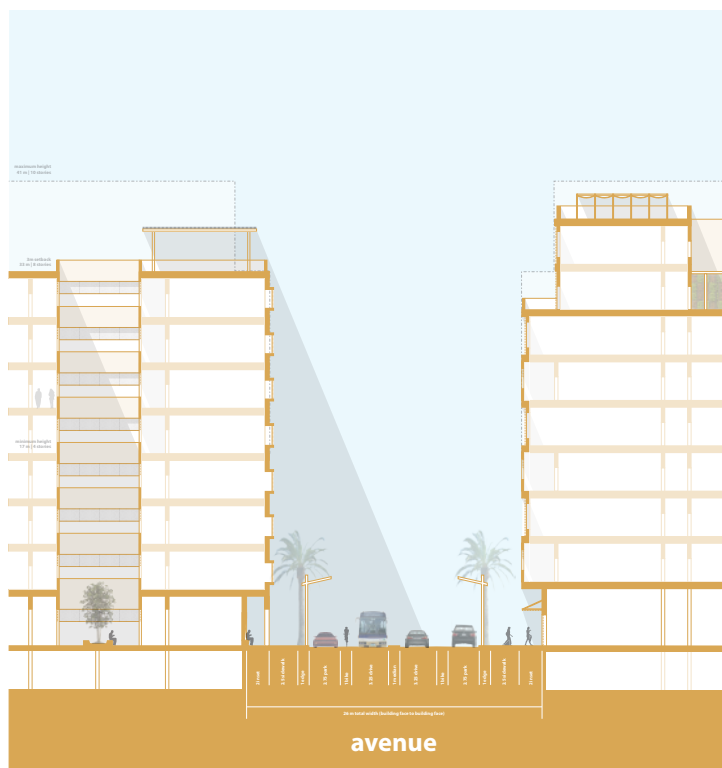
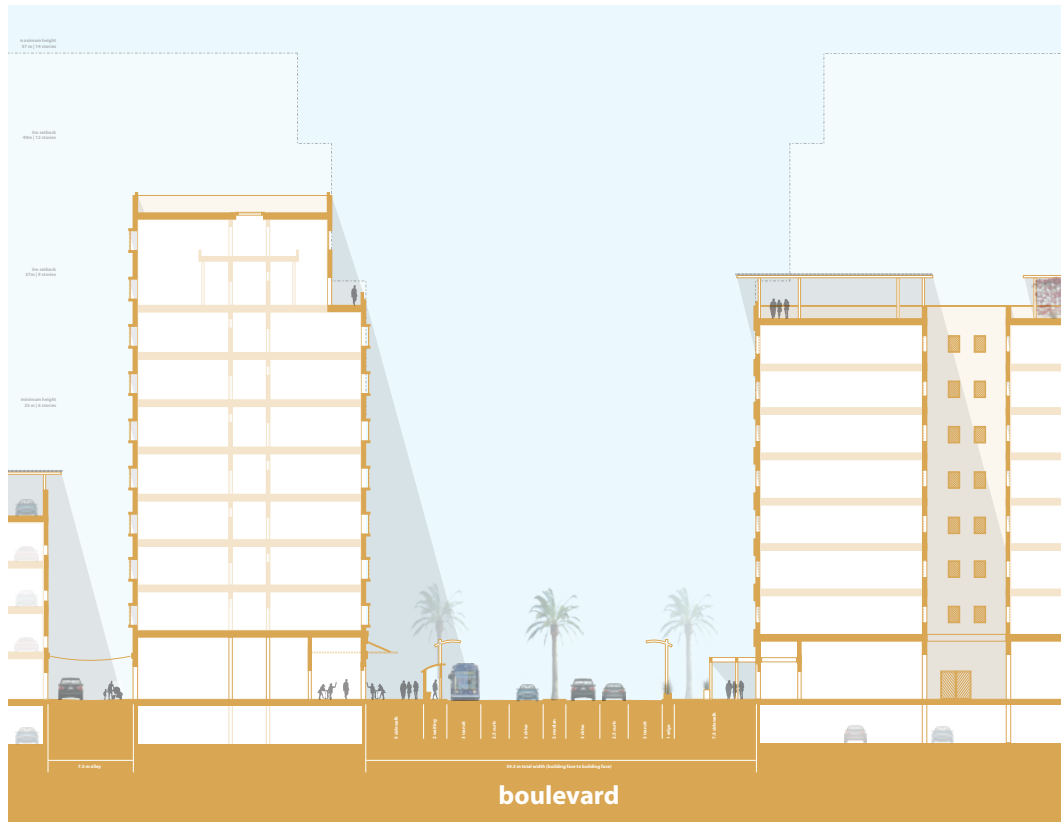
attached axonometric detail



attached ground floor

attached upper floor

Figure 38. Medium- and small-scale residential building types with details.

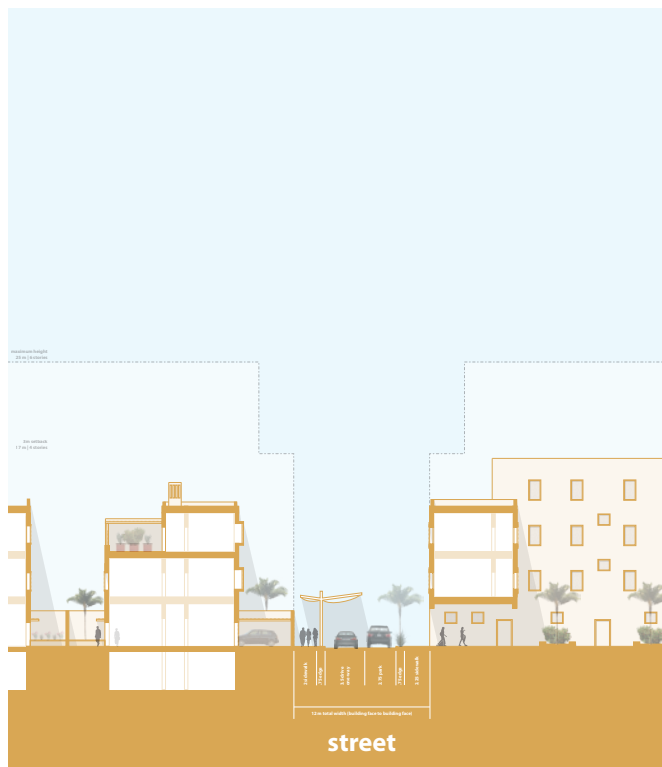


boulevard key



avenue key

Figure 39a. Prototypical street sections for the boulevard and avenue street types.



street key



parkway key

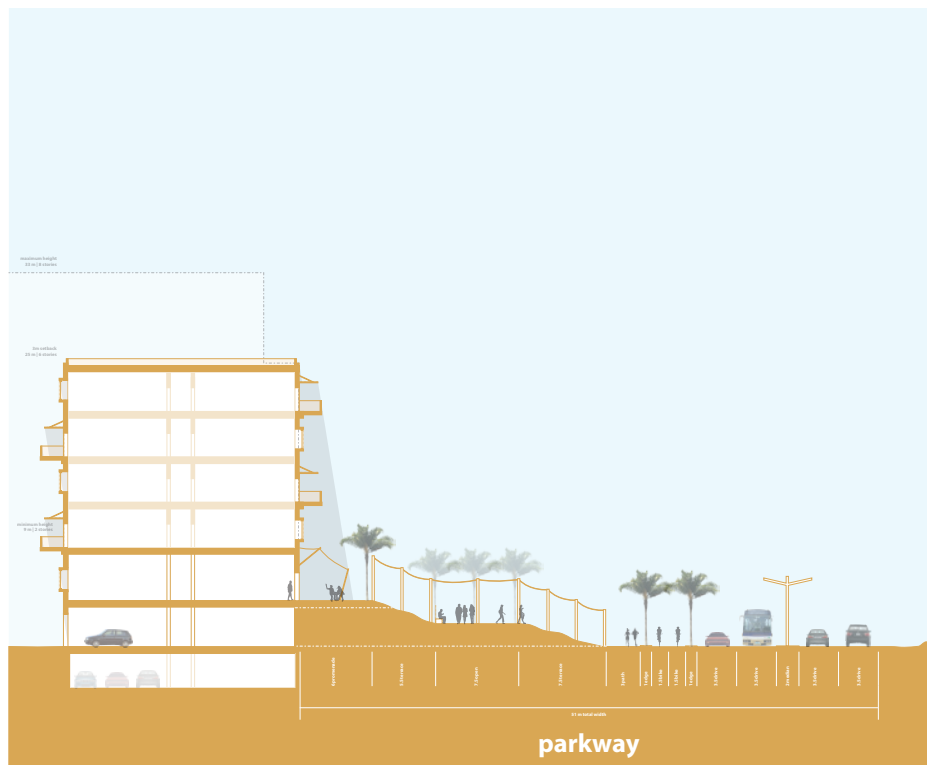


Figure 39b. Prototypical street sections for the street and parkway street types.

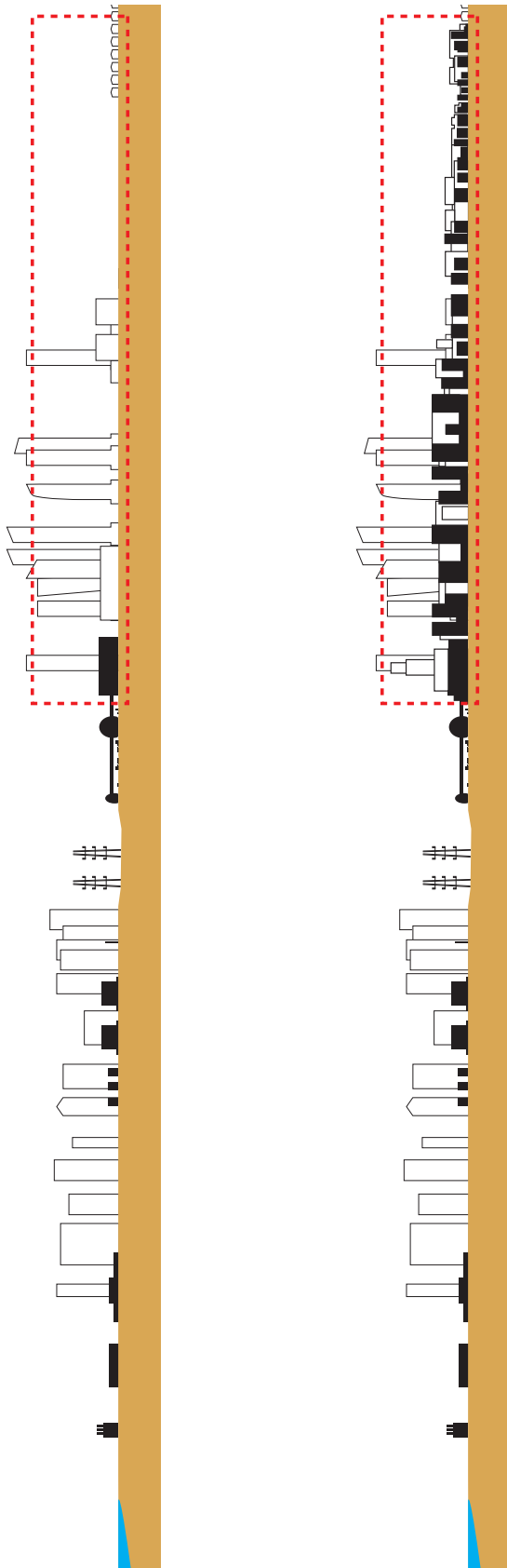


Figure 40. Left: existing site section. Right: proposed site section.

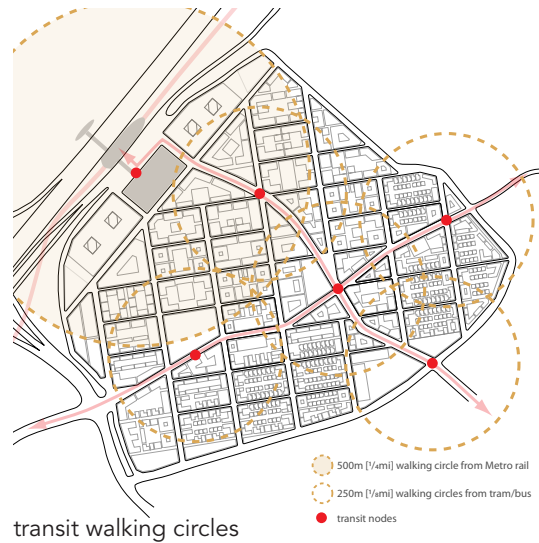
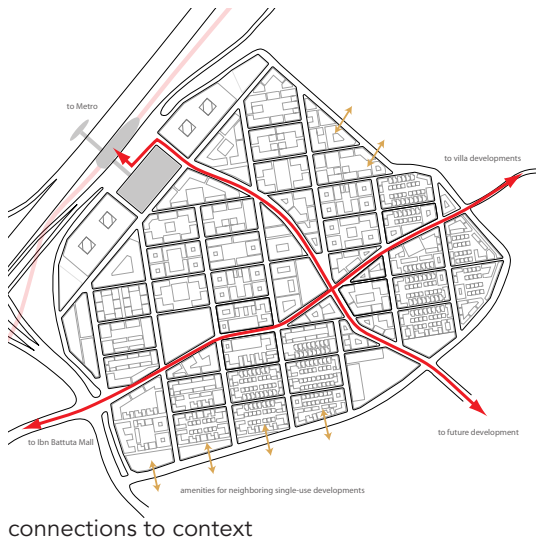
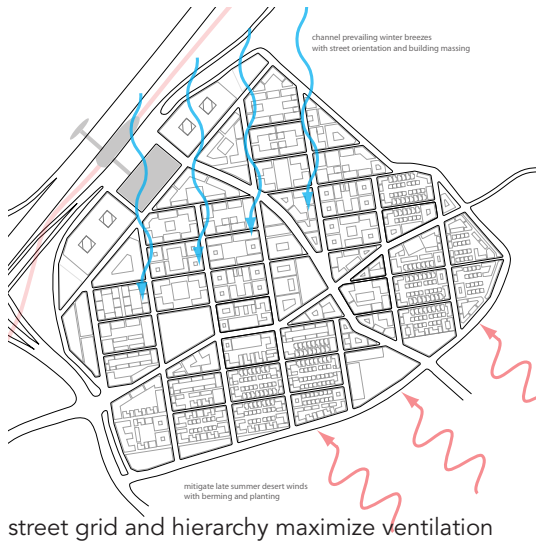


Figure 41. Site strategy diagrams.



spring equinox, 10 a.m.



summer solstice, 10 a.m.



spring equinox, 1 p.m.



summer solstice, 1 p.m.



spring equinox, 4 p.m.



summer solstice, 4 p.m.

Figure 42. Solar studies indicating how block orientation, street widths and building massing interact to optimize street shading, particularly during the shoulder seasons of spring and fall.

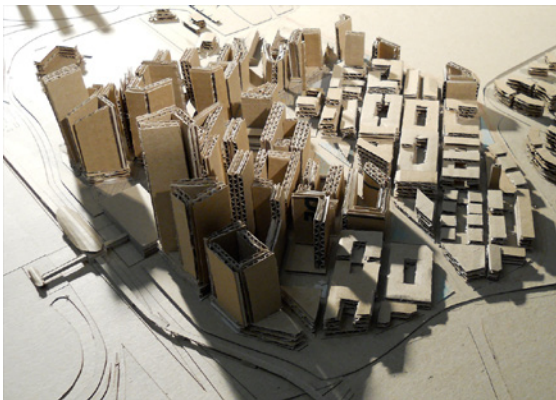
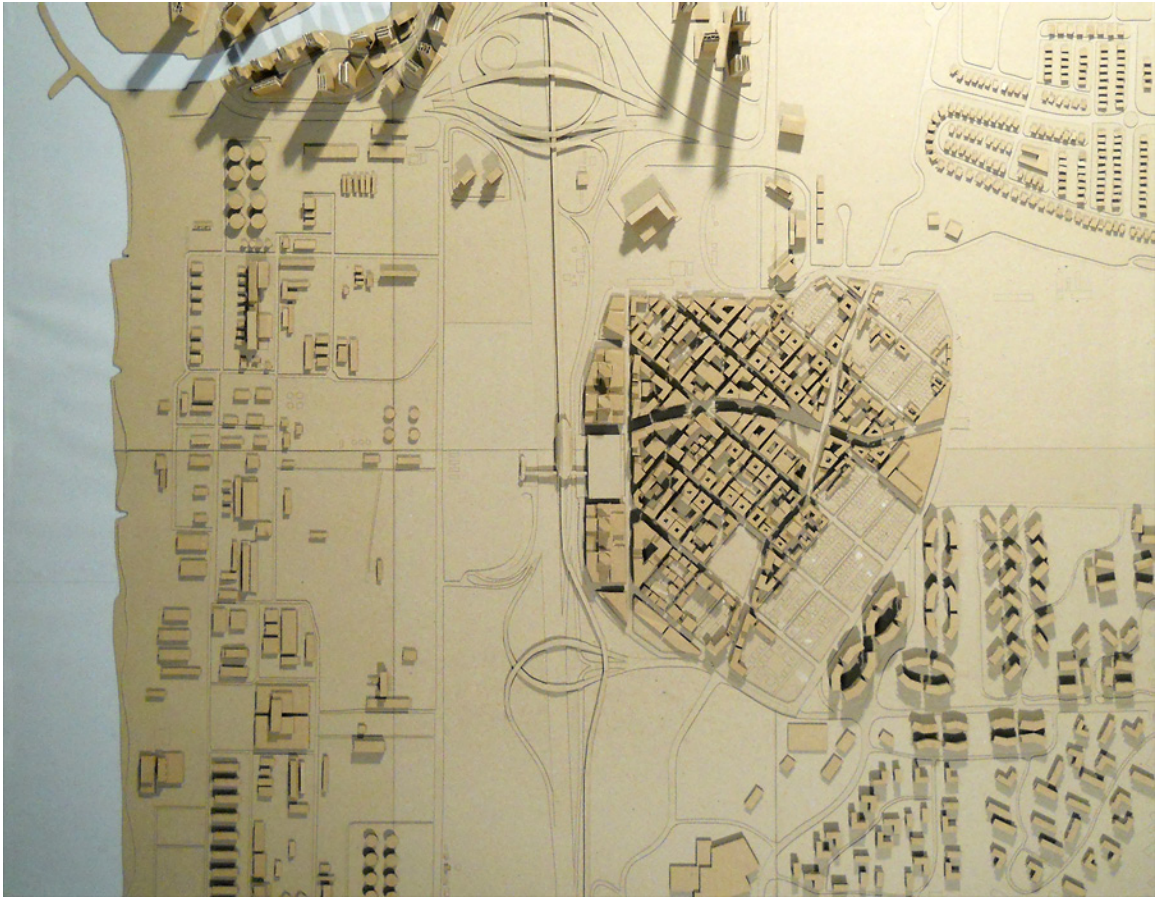


Figure 43. Physical massing models provided a tangible study method for scale and relationships to context.



Figure 44. Site plan at full build-out. Scale: 1cm=66m



Figure 45. Bird's-eye perspective view from the northwest.



Figure 46a. Perspective vignettes project how design guidelines might translate into built form.
Top: Boulevard section perspective from air-conditioned arcade. Bottom: Avenue view from sidewalk.



Figure 46b. Top: Souk/marketplace view showing tensile roof inspired by the Bedouin tent.
Bottom: View across boulevard to public square fronting mosque.

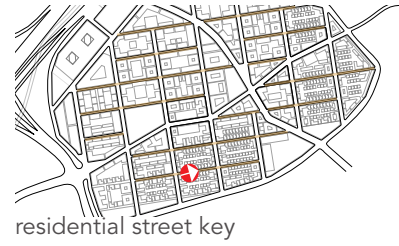
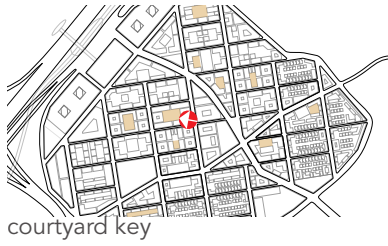


Figure 46c. Top: Courtyard daytime view shows a mixture of uses, pedestrian activity and protection from the sun. Bottom: Residential street view highlights the balance between the public and private domains.

Public Review

I presented the work to a jury of design and development professionals on December 2, 2010. The discussion focused on these issues:

- Any transit-oriented development should be carefully phased to ensure that sufficient housing and services are available to the first residents. I suggested that phasing would begin with the convention center, the development anchor located closest to the Metro station. High-density housing and commercial located close to the Metro and Sheikh Zayed Road would support the convention center. Lower-density housing to the southeast could then “fill out” the development in later phases.
- Demographics and target market should be clearly articulated. The target users represent a range of classes and nationalities, but most of them are middle-class immigrants who have come to Dubai for long-term (6 months to 10+ years) work assignments. This group is currently underserved by the Dubai housing market; there is little affordable housing in the city’s business districts, so they are forced to live in distant suburbs.
- While the housing types shown in the design offer a great variety of sizes and layouts, would they really appeal to

potential renters and buyers? Do Dubai developers continue to build American-style suburban tracts because that is what people want, or do people live there because that is the only option available? In America, New Urbanist developments such as Seaside and the Kentlands offer examples of successful alternatives to the suburban status quo. It is reasonable to believe that offering a compelling alternative could also work in Dubai.

- The quality of the pedestrian experience merits further study and design development. While the street sections and views emphasize *shared space* for pedestrians, bicycles, cars, buses and trams, the human-scale details that make great streets so compelling are critical.

Conclusion

While the urban design framework developed in this thesis is based on extensive research and analysis, it also attempts to provide space for delight. This kit of parts for environmentally- and socially-responsible urban development sets a stage for future design interventions at many scales. By investigating architectural design at the scale of the region, the city and the neighborhood—and grounding it in historical, economic and social context—I have expanded my grasp of design's possibilities.

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